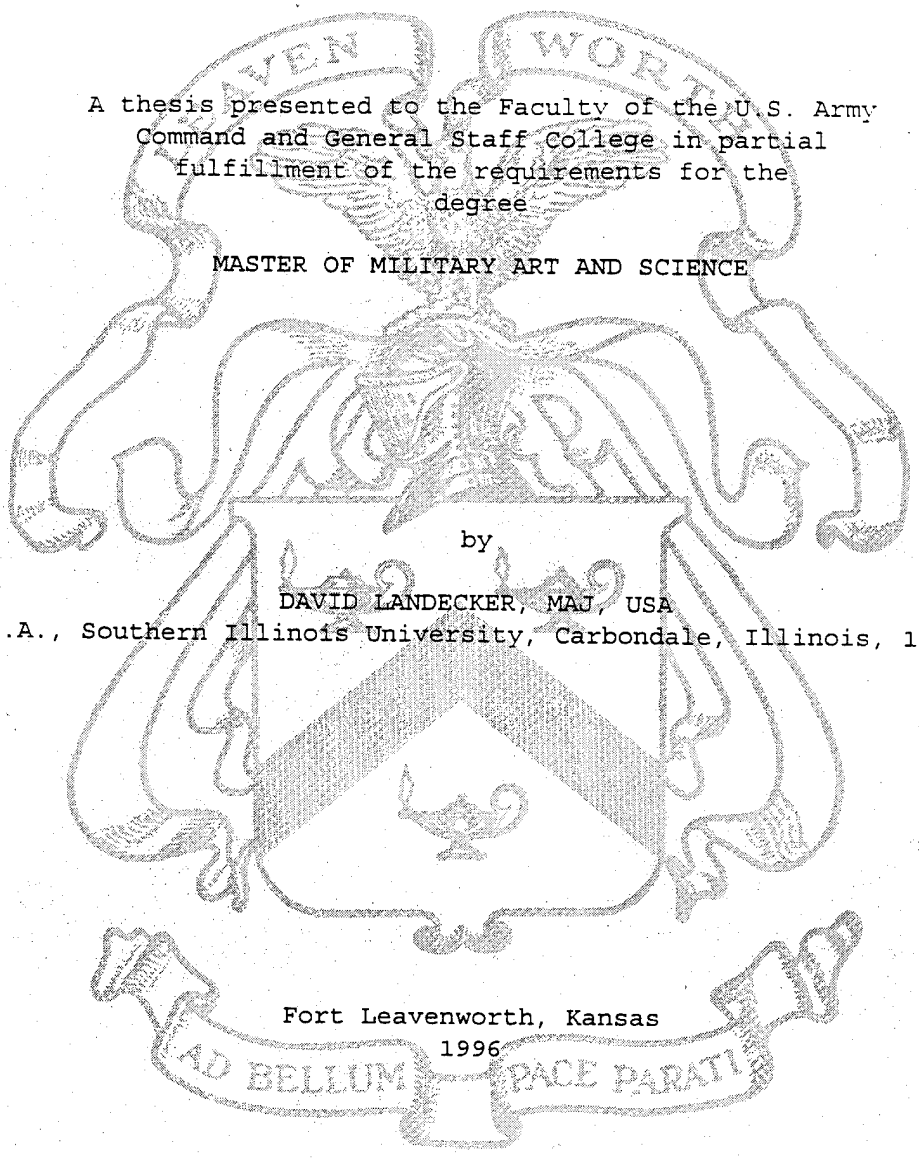
THE VIRTUAL ARMY: MANAGEMENT CONCEPTS FOR AN INFORMATION AGE ARMY



A thesis presented to the Faculty of the U.S. Army Command and General Staff College in partial fulfillment of the requirements for the degree

MASTER OF MILITARY ART AND SCIENCE

by

DAVID LANDECKER, MAJ, USA
B.A., Southern Illinois University, Carbondale, Illinois, 1983

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This paper analyzes leading edge information age management concepts future armies are likely to adopt. There are two premises which shape the research. Change is occurring, today with greater speed, volume, and complexity. War is a reflection of the societies who wage it. The findings forecast concepts that translate from the corporate environment to the conduct of war in the dawning information age. The changing environment is a driving force behind several of the latest corporate management concepts. Firms must lead or rapidly respond to many new ideas and products which may make their business obsolete. An army that fails to adapt to its changing environment also risks becoming outdated.
The thesis makes several findings. Information age firms are evolving into flat organizations that can rapidly reconfigure based on their mission. Learning organizations are more competitive in a rapidly changing environment. People and their minds are the most valuable and flexible tools of the firm to deal with the changing environment. Successful information age armies are likely to: reconfigure based on mission, reward and foster a learning environment, and value the minds of its soldiers over equipment and technology.

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The opinions and conclusions expressed herein are those of the student author and do not necessarily represent the views of the U.S. Army Command and General Staff College or any other governmental agency. (References to this study should include the foregoing statement.)

ABSTRACT

THE VIRTUAL ARMY: MANAGEMENT CONCEPTS FOR AN INFORMATION AGE ARMY by MAJ David Landecker, USA, 76 pages.

This paper analyzes leading edge information age management concepts future armies are likely to adopt. There are two premises which shape the research. Change is occurring, today with greater speed, volume, and complexity. War is a reflection of the societies who wage it. The findings forecast concepts that translate from the corporate environment to the conduct of war in the dawning information age.

The changing environment is a driving force behind several of the latest corporate management concepts. Firms must lead or rapidly respond to many new ideas and products which may make their business obsolete. An army that fails to adapt to its changing environment also risks becoming outdated.

The thesis makes several findings. Information age firms are evolving into flat organizations that can rapidly reconfigure based on their mission. Learning organizations are more competitive in a rapidly changing environment. People and their minds are the most valuable and flexible tools of the firm to deal with the changing environment. Successful information age armies are likely to: reconfigure based on mission, reward and foster a learning environment, and value the minds of its soldiers over equipment and technology.

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CHAPTER 1

INTRODUCTION

The purpose of this paper is to predict information age management concepts future armies are likely to adopt. This thesis has two premises. The first premise is war is a reflection of the societies who wage it. The second premise is the pace, complexity, and volume of change in society is very different from the past. The research methodology is a comparative analysis of management concepts generally published since 1990. The goal is to discover corporate management principles that information age armies are likely to employ.

Managers and employees often view each new management initiative as another fad to endure. The intent of this comparative analysis is to focus on the underlying principles of new concepts to discover emerging universal truths. The concepts summarized in the literature review describe new methods and techniques based on information age concepts and technology. The objective of this approach is to eliminate fads and predict information age management principles.

This thesis includes a literature review of recent corporate management concepts and theory, a comparative analysis, a description of the unique characteristics of the U.S. Army, and concludes by predicting some military applications of emerging management concepts.

The literature review provides a mix of theory and corporate examples of recent management initiatives. The analysis focuses on the

environment in which both the corporate and military organizations operate. Then it proceeds to look at four functions that assist organizations to evolve with the changing environment. These functions include: organizing, learning, reengineering, and leading.

An analysis of corporate management concepts for military applications must include a caution. It is essential to understand mistakes in business cost money, mistakes in war cost lives. Therefore, armies lead their soldiers into battle. However, battlefield leadership is outside the scope of this paper. This thesis is concerned with good management that facilitates effective leadership.

Good management can provide significant advantages to combat leaders. In military organizations, management is often scorned as an inferior substitute for leadership. Nonetheless, large armies of the leading powers since the eighteenth century combine both leadership and management to gain decisive advantages. History can provide several examples of management as a decisive ingredient of victorious armies.

In 1567, the Duke of Alba marched to suppress a revolt in the Netherlands with three *tercios* (a unit of three thousand men), plus 1,600 calvary. Half a century later, Gustavus Adolphus and Wallenstein commanded armies in excess of 100,000 men.[1] Wallenstein's army could easily outmatch the smaller mercenary armies that preceded him. His ability to manage resources and sustain a large army made Wallenstein the greatest military entrepreneur and richest man in Europe of his time.[2]

Wallenstein and other roaming mercenary armies in Europe were a threat to everyone. Finally by 1700, state bureaucracies evolved and

proved capable of maintaining a full-time force to counter these mercenary armies in both war and peace.[3] The nation's ability to manage pay, clothing, arms, food, and training for it's army proved essential to the evolution from small aristocratic to large state armies.

The Chief of Staff to Supreme Allied Command (COSSAC) plan, completed on January 17, 1944, for the invasion of Europe took three years of information-gathering and planning.[4] Perhaps these planners pulled together more disparate pieces of information than any before them. Their plans integrated national industrial production estimates, training timelines, deception measures, weather data, enemy order of battle, as well as national strategies. Effective management of volumes of data was clearly essential to deliver critical knowledge to decision makers at the right time.

In the two examples, management of resources proved essential to victory. Since the 1700s, large armies require management to sustain themselves in war and peace. In war, effective management can synchronize a variety of actions to place overwhelming combat power at decisive point on the battlefield.

Armies throughout history have evolved into more complex, highly lethal organizations. The Greek phalanx, Roman legions, Napoleon's divisions and corps, and the current U.S. mechanized divisions demonstrate this trend. Each of these organizations is many times more lethal and complex than its predecessor. Although these armies are each separated by centuries, the speed in which armies achieve the next order of magnitude is increasing. The different armies of World War I, World War II, and Desert Storm demonstrate how quickly

lethality and overall capability improved in this century alone. General Electric, Sears, and General Motors demonstrate similar trends in the corporate world. The modern armies and corporations are both complex organizations. Each manages a wide variety a resources to achieve their objectives.

It is clear the best corporations and armies today could easily dominate their predecessors of just fifty years ago. A process of transformation created more complex, efficient, and capable organizations. The corporations and armies that evolved with the changing environment made profits, impacted national policy, and dictate their desires in their perspective arenas. Therefore, all corporations and armies hope to transform effectively. Their goals include discovering relevant and accurate assumptions, heading in the right direction, and arriving at significant objectives before their enemies.

The latest corporate management concepts take aim at improving this process. A number of authors propose the increasingly rapid changing environment is accelerating the requirement for corporations to achieve significant milestones in their transformation process. These milestones might include: reducing a manufacturing cycle time from 7.5 to 1.5 days, increasing a product portfolio from 19 to 85 products, or reducing a staff from 4,000 to 400 people.

The research question of this thesis asks, what are the new corporate management concepts that transfer to future armies? The survey of recent literature suggests the impact of change is the driving factor behind new management concepts. Change is continuously changing the operating environment and corporate formulas for success.

Successful firms are constantly evolving in order to remain profitable or gain decisive advantages. This implies, the answer to the research question centers around concepts that can assist armies to effectively and continuously transform themselves.

There are two major premises in this paper. First, war is a reflection of the societies involved. Second, the pace, volume, and complexity of change in society today is very different from the past. The first premise is supported by scholars, senior U.S. officers, and futurists. The second premise is overwhelmingly supported in the literature review concerning the environment. It is a founding assumption of a majority of management concepts including: liberation management, the learning organization, and reengineering. These premises guide the research to focus on the impact of change and how armies can turn it to their benefit. The research examines corporations today and the impact of change to extrapolate how armies evolve in the next fifteen to twenty years.

In 1973, Sir Michael Howard lecture (subsequently published, under the title, "Military Science in an Age of Peace"[5]) on the military's efforts to prepare for the next war during a time of peace. These efforts are often difficult because technology, doctrine, political, economic, or social advances can change the nature of war. Napoleon's *Grande Armee* (French National Army) reflected the political and social changes of the French Revolution. These changes led to organizational not technological advantages of the *Grande Armee* over it's enemies. Previous armies (aristocratic or mercenary)were no match for the French *nation in arms* (a nationally conscripted army).

Howard explains there is a risk that armies fail to develop appropriately during peacetime and may have limited feedback to confirm their developmental process. One of Sir Michael Howard's conclusions is, "The social changes of our time may so transform the whole nature of warfare that the mode of thought of the military professional today will be, at best, inadequate or, at worst, irrelevant."[6]

General Gordon R. Sullivan, Army Chief of Staff, noted that between World War I and World War II, "Germany developed a wholly new set of operational concepts and doctrine for warfighting, reflective of the economic, social, and technological changes of the time."[7] The incremental changes in warfighting doctrine and equipment of France and Poland from 1919 to 1939 were irrelevant in the face of blitzkrieg operations. Great Britain and the U.S. were more fortunate and afforded the necessary time to evolve and defeat Germany.

The corporate management techniques, surveyed in this thesis, direct the transformation of firms in accordance with the environment. The most successful firms lead change and may actually change the environment. The success of the Cable News Network (CNN) has earned large profits and changed our environment. The French Revolution changed the social environment in France. Consequently a powerful army emerged that forced other nations to transform their armies and perhaps societies as well. The environment in Germany incorporated economic, social, and technological changes. In the 1930s, once again a dominant army (this time in Germany) grew by integrating environmental (economic, social, and technological) changes into an effective warfighting organization and doctrine.

The Tofflers state, "Starting with the very invention of agriculture, every revolution in the system for creating wealth triggered a corresponding revolution in the system for making war."[8] They group mankind's methods for creating wealth into three periods: an agrarian age; an industrial age; and now an information age (frequently called the third wave).

The Tofflers contend the conduct of war is a reflection of these three periods. The agricultural age made terrain valuable, prompted seasonal conflict, and provided an economic surplus for groups to envy. The industrial age and mass production encouraged the *levee en masse* (national conscription), larger organizations, training, standardized weapons, doctrine, and wars of attrition. Industrial nations proved many times more powerful than "first wave" nations still in the agricultural age. Information age nations may gain similar advantages over their less developed neighbors.

Sir Michael Howard, General Sullivan, and the Tofflers support the premise, war is a reflection of society. The Toffler's third wave society, currently emerging, provides new discoveries to develop innovative warfighting doctrine and operations. The challenge for today's armies is to transform themselves as the environment changes from an industrial age to an information age. The most successful armies, like successful firms (CNN) will lead change and transform the conduct of war.

The next chapter is a review of relevant literature. The sources related to corporate management are generally limited to those published since 1990. This chapter employs a framework that is repeated

throughout the thesis. Chapter four, describes some unique characteristics of the U.S. Army. While the research is aimed at discovering universal military applications of leading edge management concepts, this chapter is for those interested in the U.S. effort to transform it's army. The thesis concludes by stating which current and near-term management principles future armies are likely to employ.

The literature review provides a background of current management thought on the changing environment and four methods to assist organizations transform for future operations.

Corporations and armies operate in the same global environment and face similar challenges. Corporations face relentless pressure from multi-national conglomerates, state subsidized firms, and smaller agile firms hungry for profits. Armies are threatened by traditional military organizations, guerrilla armies, terrorists, and even organized crime. In the past, corporations survived by producing more with less cost. Today, firms survive when they are first to market with a new idea. In the past, the U.S. Army (an industrial army) was measured by its ability to produce more than the Warsaw Pact. Industrial armies often won through attrition. Evolving information age armies may be judged in the future on the speed and effectiveness of their response to the increasing variety of potential threats.

Today, the corporate environment suggest firms constantly transform themselves to remain competitive. The consequences of reacting instead of leading change are occasionally catastrophic. Large firms are especially vulnerable. Of the fortune 500 companies in 1955 and 1979, 70 percent and 40 percent respectively no longer exist.[9]

The first method described in the literature review to assist organizational transformation is restructuring. The ideas concerning structure are covered under a functional heading, organizing.

With the exception of General Electric and perhaps Boeing, U.S. firms are racing to reduce bureaucracy and become more responsive to customer demands. The corporate perception is smaller companies are hungrier, more responsive, and more profitable. The emphasis on responsiveness to demand versus advantage of capacity is a significant change from only 30 years ago. The global market now rewards firms who deliver quality over price. Today, customers demand quality and responsiveness.

A number of proposed third wave organizational models focus on a system approach and processes that connect the workers with each other and management. Charles Handy, a former professor at the London Business School writes, "organizations will be very different, much more like networks than machines."[10] Margaret Wheatley, a management professor at Brigham Young University, uses examples found in quantum physics, chaos theory, and biology to provide new metaphors for organizations in the information age.[11] William Bridges, a management consultant, believes jobs on organizational charts can no longer keep up to provide the flexibility and responsiveness required in today's market place. His predicted structure is, "patterned like an energy field, and leaders function as energy nodes around which activity clusters."[12]

The second approach to corporate transformation is to establish a learning organization. The current thought on this approach is reported under the functional heading, learning.

Learning organizations improve their potential to lead change and are less likely to react to it. These firms dedicate resources towards employee and management education. As a result, they improve their ability to forecast, analyze current operations, and adapt innovative ideas.

General Gordon R. Sullivan believes a transformation of the Army begins with intellectual change. He wrote in 1995, "To effect the continuous transformation required by today's environment, the Army had to become a learning organization in every sense."[13] Arie De Gues, head of planning for Royal Dutch/Shell, stated, "The ability to learn faster than your competitors may be the only sustainable competitive advantage."[14] This section of the literature review provides a foundation to analyze learning organization techniques that transfer from the corporate world to military organizations.

The third approach to corporate transformation is reengineering. Most readers will associate this term with reducing corporate structure. This is often a result of reengineering not the goal. A reengineer examines processes and makes recommendations to improve them. The current thought on this approach is reported under the functional heading, reengineering.

In the information age, many firms begin change by improving processes that expand capabilities and profits. The Cable News Network (CNN) and Federal Express, two modern information age companies, improved the process of delivering information. As a result they gained large market shares and became profitable. Reengineers change the scope

of jobs to address functions not tasks. As a result, firms can dramatically improve cycle times, quality, and job satisfaction.

The final approach, covered in this thesis, is to embrace new leadership styles appropriate for information age workers. The changing environment is altering the workers view of employment, their education level, and the rewards they desire. Current ideas to approach these changing realities are included under the functional heading, leading.

Corporate leadership is changing in relation to the value and expectations of knowledge workers, the emerging majority of labor. In the information age, workers are no longer cogs of the machine. In the industrial age, workers went to the factory to operate expensive machinery. The cost of labor was typically a fraction of the cost of a factory. Today, the knowledge of Microsoft's software developers is more valuable than their place of work. Knowledge workers who solve problems, think ahead, and bring a measure of creativity to the firm require different leadership than the industrial workers they succeeded.

Peter Kline and Bernard Saunders, proponents of learning organizations, write, "Managers can no longer rely on military styles of management and must move in the direction of becoming teachers, coaches and facilitators instead."[15] This comment should not be read as a judgement on the U.S. military. It is included to point out the differences between industrial leadership and the emerging leadership imperatives of the information age.

The analysis chapter suggests military applications of corporate management initiatives. The study examines today's environment and the four functions which assist organizations to change

with the environment. Armies and corporations are both complex organizations that must deal with a global environment. Corporate innovations, tested in the global market, may prove an inexpensive test-bed for military management reforms.

The next chapter describes the U.S. Army's unique characteristics. It builds on the universal findings of the analysis and points out peculiar issues for the U.S. Army as it transforms itself into an information age army.

The conclusion highlights leading edge management concepts any information age army is likely to employ. I predict an information age army (regardless of nationality) will eliminate non-essential layers of command, recruit high quality soldiers, shift critical decision making forward, reward those who learn and succeed, retain those who risk and grow. The U.S Army is already moving towards some of these directions. Today, global marketplace competition is a relentless force pushing organizational transformations. Since today's most powerful armies are complex organizations, they can learn lessons in peacetime from corporations facing global competition. The challenge to either organization is improving their ability to learn, adapt, and grow stronger.

CHAPTER 2

LITERATURE REVIEW

Every large bookstore stocks 100 books on business with a large percentage dedicated to management. There are so many new books that the public views topics such as downsizing, reengineering, total quality management, and new styles of leadership with cynicism. This chapter groups the recent management concepts in five sections in order to build a foundation for analysis and derive a few universal principles from many concepts. The sections include the environment and four functions: organizing, reengineering, learning, and leading.

The literature reviewed for this paper suggests change is the most important factor behind new management concepts. The pace of change documented in the business environment is changing the conduct of business. It implies the conduct of war may experience change as well.

General Sullivan describes change as both a condition and a process. As a condition, it is universal and affects everything. As a process, it is the act of transformation.[1] The environment section reviews the condition, change, and its impact on business organizations. It also discusses some new theories which deliver a different perspective of the environment. The process of change, in relation to organizations, is reviewed in the sections covering the four functions. These functions are methods organizations can use to transform themselves.

Environment

The environment today is being shaped by information. The industrial age was driven by machines and production. The new age is guided by information. In the information age, telecommunications, the Internet, and mass media speed the transfer of years of accumulated knowledge. The information can travel at the speed of light along fiber optic channels. The increasing pace, volume, and complexity of change is directly related to this transfer of knowledge.

Peter Drucker, a well known social scientist, believes knowledge is becoming the primary resource in our changing society. Land, labor, and capital are becoming secondary factors.[2]

Don Tapscott writes, "We are at the Dawn of an Age of Networked Intelligence—an age that is giving birth to a new economy, a new politics, and a new society."[3]

Tom Peters writes, "During recent trips to Asia, Oceania, Europe, the Middle East, and Latin America, I couldn't help but note that every developed and developing economy is pursuing precisely the same strategy: 'Create a value-added, knowledge-based, export-led economy.'"[4] Many Americans believe nations, outside Europe, Japan, and the U.S., are still making products by hand. In fact these three leading economies face competition in some surprising areas. Korea's Samsung in 1994 was the number one producer of semiconductor memory chips. Bangalore, India is a center for software development. Singapore is a global hub for telecommunications, banking, and logistics.[5]

A significant number of management experts begin the description of their concepts by describing the impact of the environment on organizations. Today, the pace, volume, and complexity of change rapidly alter the principles upon which organizations are founded. The pace of change describes how rapidly the world is transforming due to new technology and new knowledge. The volume of change means there are more new events, discoveries, or technologies than small organizations or one person can track. The complexity of change is often due to the specialized knowledge required to make or understand the new breakthroughs. Successful firms are adapting a strategy of continuous transformations to deal with the three dynamics of change.

Each of these dynamics, pace, volume, and complexity effect firms in different ways. There are a variety of techniques and concepts corporations can employ to cope with change. General Sullivan believed change is an opportunity for the U.S. Army based on the nation's scientific base, technological base, and intellectual capacity to gain opportunities from change.[6] The three following sections describe the impact of the three dynamics of change in the corporate environment.

Pace of Change

Today, the speed of change can provide a competitive advantage. In 1981, Yamaha and Honda were embroiled in a competition to dominate the motorcycle market. Yamaha decided to build a factory that would make it the number one producer of motorcycles in Japan. Honda responded by producing 60 new motorcycle models. In the next eighteen months they delivered 113 new models to the market. Yamaha could not

maintain Honda's pace and publicly "surrendered" to Honda, a remarkable event in face conscious Japan.[7]

The computer aided design programs and information systems that assisted Honda impacted on the U.S. economy as well. Honda and Toyota began to deliver cars from concept to market in three years. General Motors and Ford traditionally took five years to complete the same process.[8] Xerox lost market share to Japanese competitors who developed copiers with the latest technology twice as fast at half the cost.[9] The speed of product development resulted in the loss of market share for less agile firms.

One of the largest corporations in the world, International Business Machines (IBM), recognized the rewards and penalties involved in speeding change and it's positive effects to market. Between 1991 and 1994 the IBM personal computer operation reduced its product development time from 24 to eight months, its manufacturing cycle time from 7.5 to 1.5 days, increased the product portfolio from 19 to 85 products, and downsized from 1,100 to 423 people.[10]

An American company, Cable News Network (CNN), used the speed of change to derive a lucrative profit formula. The network began with a concept of showing news live or as the story was breaking. Newspapers, magazines, and network news traditionally hustled for stories, polished them, and delivered them to the customer when they (the companies) were ready. The technology of satellites and distribution of video cameras around the globe provided CNN the opportunity to become a global, live news network. Network executives either assumed the audience preferred an analyzed and polished product or failed to consider a competitor with access to live video from

amateurs around the globe. The failure of the networks to analyze the assumptions of their business in the information age led to a significant loss of their market share.

The entire globe is producing sophisticated products at an unprecedented pace. If a corporation can not deliver a product on demand to its customer, someone else will. If the corporation can not improve its product, someone else will. What is common in all these examples? The firms harnessed knowledge and information age technologies to speed change into their organizations, products, and cycle times.

Volume of Change

The volume or quantity of change is related to the speed of change. The faster things are developed the greater the quantity of change. However, the increasing number of innovations cause a variety of impacts not related to the speed of change.

The quantity of change is reflected in the number of new products that are awarded trademarks or patents. A review of recent awards demonstrates the U.S. is no longer dominating innovation. U.S. trademarks, an indicator of brand-new products, ran under 30,000 annually until 1980. In 1985, the U.S. government issued 65,800 trademarks.[11] U.S. Patents went from an average of 109,000 to 127,100 per year, during the same time period. In addition to the increase in number, the patents awarded to foreign corporations and individuals went from around twenty percent in the 1960s to over fifty percent in the 1970s.[12]

Firms that hope to remain competitive in this environment must constantly reassess their changing environment in an almost daily routine manner. It is important to look beyond the boundaries of their core business. Failure to discover a new important change effecting the organization can have a catastrophic impact.

Peter Drucker suggests organizations follow a process to systematically examine themselves and decide how and when to change. The first step is to examine the assumptions about the environment, mission, and core competencies and determine if they still fit with reality. Second, determine if the assumptions in all three areas support each other. Third, find out if the theory of the business is known and understood throughout the organization. Finally, if the first three answers are positive, then constantly test the theory of the business through models or other means.[13]

The failure of railroads to remain dominant transportation companies, of IBM to produce a majority of computers, of network news to compete with CNN demonstrates the consequences of not routinely reevaluating the underlying assumptions and realities of the business. The increasing quantity of change is likely to make this task more difficult and crucial.

Peter Drucker recommends an organization challenge every product, service, policy, and distribution channel every three years with the question, "If we were not presently doing this, would we be going into it now?."[14] If an organization fails to carry out a systematic approach to abandonment it will end up squandering resources.

Today, it is also essential to study what goes on outside the core business. About twenty years ago department stores were at the

height of their success. They served about thirty percent of the non-food retail market. Their theory of business was based on the assumption, people who could afford to shop in department stores, did. While that assumption may have been true fifty years earlier when the store was founded, the environment changed. Time became the crucial factor for the new dual income families.[15] A study of the remaining seventy percent of the market not shopping at the department store may have provided a clue to evolve and provide faster service.

Railroad and pharmaceutical companies reinforce the lesson. The railroads did not fully meet the challenges from advances in automobiles, trucks, and airplanes. Today, the pharmaceutical industry is being changed by advances in genetics and microbiology. Few biologists were even aware of these disciplines forty years ago.[16] In the information age, executives will have to look outside their expertise or their box to remain in business.

Successful corporations bring innovations to the market before their competitors. Peter Drucker defines successful innovations as those that exploit changes that have already happened. They exploit the time lag in science between the breakthrough, its perception, and acceptance. Drucker's examples include the transition of freight from rail to trucks, and the shift to the telephone as the primary means of long distance communication.[17]

The increasing quantity of change suggest firms constantly transform themselves to remain profitable. Today, enterprises are bringing a variety of new, innovative products to the market and eliminating those who can not adapt.

Complexity of Change

Change is becoming more complex as the innovative breakthroughs are often derived from specialized knowledge and significant research. Some of the recent patents are rewarded after years of research and development. The new concepts can be difficult to discover and complex to understand. Yet, corporations are not required to make all the discoveries in order to reap the profits. In fact one expert suggests a 20 to 30 year time gap exists between discovery and a marketable product.[18]

Commercial flight demonstrates how one company profited from the breakthrough of others. The Wright brothers demonstrated that powered flight was possible in 1903. Yet, McDonnell Douglas only introduced the DC-3, the first successful commercial carrier in 1935. It took three decades to discover the variable pitch propeller, retractable landing gear, a lightweight body construction, a radial air-cooled engine, and wing flaps.[19]

Foreign competition followed the McDonnell Douglas example and proved adept at improving U.S. technology and taking market share away from U.S. firms during the 1980s. In 1987, the U.S. had one percent of the phonograph market ($630 million) that it had created. Between 1970 and 1987 the U.S. share of the $14 billion domestic color television market shrunk from 90 percent to ten percent. Command of the telephone market went from 99 percent in 1970 to 25 percent in 1987.[20]

In the late 1980s, the U.S. had 15 million companies, 5.5 million scientists and engineers (twice the number of Japan), and won more Noble prizes than the rest of the world combined.[21] Yet, Japan was

notably able to take away a majority of market share in a number of American developed markets.

The complexity of change has two impacts on business firms. First, organizations can prosper by understanding complex innovations and being first to market with an appropriate application. Second, firms risk losing profits and market share because the global economy can rapidly improve on their complex innovation with a margin of the initial cost. A modern organization balances its resources towards developing new products and retaining profitable markets.

Theory

In the mid-1980s, a small number of researchers, gathered in New Mexico to study complexity, adaptation, and chaos. The scholars included Nobel laureates Murray Gell-Mann and Phillip Anderson in physics and Kenneth Arrow in economics. They helped begin the Santa Fe Institute. They believed new ideas from disparate subjects like neural networks, ecology, and artificial intelligence would yield a new understanding of the spontaneous, self-organizing dynamics of the universe. In the words of their founder, George Cowan, they believe they are creating "the sciences of the twenty-first century."[22] Margaret Wheatley, in Leadership and the New Science,[23] uses some of their discoveries to formulate organizational theories.

A review of this new scientific theory is relevant because a number of management experts are digesting the findings of new science and developing new metaphors for business organizations and the environment.

Margaret Wheatley focuses on new science and organizations. She uses concepts discovered in new science and creates metaphors to describe how and why organizations evolve. Wheatley discusses quantum physics, self-organizing systems, and chaos theory. Quantum physics challenges the Newtonian perspective of the universe. A Newtonian thinker believes the environment can be divided into infinitely small parts, observed, analyzed, and predicted. Self-organizing systems are complex systems that evolve to a higher order of complexity and adapt to their environment. Chaos theory takes a holistic view of the universe. Chaos theorists reject the search to explain a system through quantities of parts so small they can not be fully measured or appreciated. Instead, they study shapes in motion.[24]

Wheatley writes, "The Newtonian model of the world is characterized by materialism and reductionism—a focus on things rather than relationships and a search, in physics, for the basic building blocks of matter."[25] She believes this process of reducing systems into parts has impacted not just organizations but everything in the world over the past 300 years. Knowledge has been broken into disciplines, engineering became a valued science, and people counseled to use different "parts" of themselves in different environments.[26]

In the world of quantum physics, things have disappeared and relationships are all important. The scientists found "things" changed form and properties as they responded to one another. These "things" are no longer billiard balls moved around by contact forces, they are electrons, photons, nucleons, that are now position, now momentum, now particles, now waves, now energy and all in response to one another.[27]

As a consultant, Margaret Wheatley studies a variety of organizations. She believes business organizations share common qualities with quantum physics. As a result, she fights the urge to critically examine tasks, functions, and hierarchies (Newtonian). Instead she focuses on the patterns of relationships and the capacities available to form them.[28] Quantum physics teaches one measure of good structure is the capacity within the system to form productive relationships.

Margaret Wheatley then turns to self-organizing systems to explain how successful firms adapt to change. Self-organizing systems are simply organisms that adapt to change. Many corporations fear change. It consumes resources, makes their product obsolete, and ultimately may force them out of business. An ancient Chinese curse says, "May you live in interesting times." People value balance or equilibrium. Wheatley proposes we fear change because it uses up valuable energy and leaves us with only entropy (entropy is an inverse measure of a system's capacity for change).[29]

In 1987 a visiting professor to the Santa Fe Institute, John H. Holland of the University of Michigan, gave a lecture on the economy as a "complex adaptive system" and defined the term. In the natural world they include brains, immune systems, cells, and ant colonies. In the human world, political parties and scientific communities qualify.[30]

These systems share certain key properties. First, they are networks of many agents working in parallel. In the brain, the agents are nerve cells. In business cycles, the agents are industry's firms. Control is highly dispersed. The brain is not controlled by one neuron. The economy is not controlled by any agency. Second, there are various

levels of organization. Within the body the brain is organized along cells, tissues, and organ levels. Factories, corporations, and industries (auto) represent a similar trend in the economy. Third, the systems anticipate the future. Holland believes every adaptive system is constantly making predictions based on its own models (its implicit and explicit assumptions) of the world. Finally, these systems have niches that can be exploited by an agent prepared to fill the void.[31]

An army can fit this model. Many soldiers, civilians, and politicians work in parallel to operate the organization. No one person or select group totally controls a large army. An army has various levels of organization from squad leader to national commanders. All successful armies are constantly adapting based on their perceptions of the future. Finally, change creates niches for new technology (long-range missiles) or ideas (the pentomic division).

The new scientists determined adaptive systems were capable of exchanging energy, and entropy was not an inevitable path. These systems absorb the changes in the environment and over time reorganize to more efficiently use resources and exist within its environment.

Our bodies are self-organizing systems. If I begin running after two months off, then my legs will hurt the next day. The next run is a little easier and less pain follows. A month later, I'm running farther and faster with less pain. In addition, my body's metabolism is converting fat to muscle. Over 30 days, my system adapts to stress and becomes more efficient. Self-organizing systems disprove the assumption, balance is good. In fact balance and equilibrium lead to entropy. Perhaps long-term balance is due to an inability to interpret a changing environment.

Wheatley's study, of self-organizing systems, leads her to believe firms organized around core competencies are prepared for an environment of change. A core competency of skills rather than business units can rapidly take advantage of opportunities. It is not locked into the boundaries of predetermined end products. These companies are more sensitive to the environment because they are seeking new markets for their core of values. Traditions, competencies, and culture guide the transformation of companies through uneasy times.[32]

The last major area Wheatley deals with is chaos theory. Chaos is the final state in a system's move away from order.[33] With the progress of computers, scientist can now plot the infinite points derived from non-linear equations that define their models. Just as everything should appear totally at random, a strange attractor comes in and pulls the infinite points into a shape. The shapes of these non-linear models can represent fractals, or clouds, or the leaf of a fern.[34]

If we believe the universe and the economy includes non-linear models, than chaos theory has an application to the firms in the economy. Wheatley proposes managers step back from a reductionist search and consider the whole system. People should look for themes and patterns rather than isolated causes. Finally, leaders should strive for an accurate focus, rather than hands on control, to allow firms to adapt and evolve efficiently.[35]

Environment Section Summary

The global environment in which both armies and corporations operate is shaped by the condition of change. Today, the increasing

pace, volume, and complexity of change bring risks and opportunities to existing organizations. Honda and CNN prospered from the speed (pace) of change. The volume of change is generally a negative factor for existing corporations. Numerous changes cause organizations to devote resources to continuously examine the environment and adapt to changes or risk obsolescence. The railroads and network news were negatively impacted by changing technology. The complexity of change is facilitated by the rapid distribution of knowledge, sometimes at the speed of light. It implies existing organizations require knowledge workers to accurately or adequately interpret the more complex changes.

The section on theory is included because it provides a new perspective of the environment that is gaining support. Margaret Wheatley is a management professor and consultant who applies the theories of new science to the organizations she studies. She concludes a process of reducing problems into their smallest parts is futile. Instead, she recommends problem solvers step back and look at the whole. She fights the urge to examine tasks, functions, and hierarchies. Instead, she prefers to measure the potential for productive relationships in the organization. Perhaps her most interesting comments deal with self-organizing systems. She finds balance leads to entropy. Change and imbalance cause organizations to evolve, grow complex, and in the end become more efficient. She concludes organizations with core competencies are better prepared to adapt to change.

The four functions (process of change) described in the next four sections interpret the environment, anticipate the future (self-

organizing systems), and assist organizations to transform into more efficient systems.

Organizing

In the information age, firms are removing layers of bureaucracy to speed the flow of information. Speeding information proved decisive for Honda, CNN, and Federal Express. Organizing to improve the speed of information and subsequently the ability to rapidly adapt to the environment is often the first recommendation of management experts. It is a process that facilitates the transformation of an organization.

The experts propose a variety of new structures that go by many names. Tom Peters calls it the "crazy organization."[36] Davidow and Malone describe it as the "virtual organization."[37] Peter Drucker calls it the "networked organization."[38] William Bridges names it the "de-jobbed organization."[39] These experts are attempting to transform Byzantine industrial structures into organizations with the hunger and responsiveness of small organizations.

Recent statistics demonstrate the scope of firms transforming from large corporations into medium or smaller sized organizations. Since the 1987 stock market crash, big business in the U.S. has laid off large numbers of employees. At the same time, the economy has enjoyed great growth and employment grew faster than population in 1990. Between 1985 and 1990, American manufactured-goods exports actually increased 80 percent in volume, the fastest growth in peacetime America. With the exception of two large companies (General Electric and Boeing), it was accomplished by medium size firms, with sales (1990 dollars)

greater than $75 million to less than $1 billion.[40] The evidence suggests corporate downsizing is simply moving jobs away from big to medium or smaller firms. The U.S. economy is not losing jobs it is in fact growing them.

With the exception of General Electric and perhaps Boeing, U.S. firms are racing to transform themselves into flatter, more responsive organizations. The corporate perception is smaller companies are hungrier, more responsive to demand, and ultimately more profitable. The emphasis on responsiveness to demand versus advantage of capacity is a paradigm shift for larger corporations. Since the dawn of the industrial age, firms reduced costs to customers and improved profits with economies of scale. In the late 1970s, the global market place rewarded companies who delivered a quality product over price. Today, customers expect quality and reward responsiveness.

Jack Welch's (CEO of GE) 1992 annual report is often quoted in business discussions. In the report, he stated, "What we are trying relentlessly to do is get that small-company soul—and small-company speed—into our big company body."[41]

One of the most successful executives in the world is Asea Brown Boveri (ABB) chief, Percy Barnevik. In 1980, he took over the Swedish firm, Asea, and downsized the staff from 1700 to 200 in 100 days. In 1987, he merged with Switzerland's Brown Boveri and reduced the staff from 4,000 to 200. Today, Barnevik runs a 210,000 man organization with a corporate staff of 150 people. Furthermore, only three layers of management separate him from the 190,000 people who do the real work.[42]

Margaret Wheatley believes the layers of bureaucracy absorb and reduce data to fit the boxes on an organization chart. Data is often skewed and the firm is insulated from a changing environment. She believes organizations should be more like streams and states, "Streams have more than one response to rocks; otherwise, there'd be no Grand Canyon. Or else Grand Canyons everywhere. The Colorado realized there were other ways to get ahead besides staying broad and expansive."[43]

ABB's structure is divided into 5,000 profit centers, each employing an average of 40 people.[44] Each profit center has it's unique methods to conduct business. This firm can flow around rocks. Like the Colorado River it is not required to stay broad and expansive. Clearly this firm has the soul of a small company.

Tom Peters believes professional service firms are a good model for information age management. In these models, teams of experts provide more value than bureaucracy or unnecessary structure. Peters began his professional career with management consultants, McKinsey & Company. He uses this firm as a good model to illustrate the benefits of little structure with a complex environment. Brian Arthur, a one-time McKinsey employee, is a founding fellow of the Santa Fe Institute. He stated McKinsey's, "approach was to absolutely revel in the complexity, to live with it and breathe it."[45] The McKinsey team would live with an organization, examine patterns, derive theories, and finally come up with an acceptable explanation. McKinsey is clearly a knowledge firm that is based on solving the issues derived from a fluid environment.

Tom Peters describes the McKinsey culture in his book, Liberation Management. This firm sent out thousands of experts around

the world in teams of ten or less. On the first day he arrived, he was issued keys and credit cards and told to hop a flight to New York that afternoon. Over the next few days and weeks he met his team and contracted with specialists for critical information required for his research. The project was everything. The culture of the firm was learned as consultants joined one team, concluded the project, and joined another. This huge firm has offices in 25 countries, little structure, and very few superstars.[46]

McKinsey & Company gained an advantage by moving decision makers forward or out into the environment. As a result, the firm makes decisions faster and better than its competitors and remains in step or in front of change.

CNN has a similar approach to structure. It operates a state of the art organization that runs carnival-like meetings to manage the daily news. Nine department heads gather in the same area, listen to each other, read papers, talk with reporters on different continents, and make million dollar decisions in seconds all at the same time![47] This organization does not have committees or rely on functional staffs to conduct a meeting.[48] CNN is live. Perhaps the atmosphere is similar to attempting to manage resources in the chaos of battle.

In this example, decision makers did not eliminate a traditional meeting. Instead, they've changed the format. The input to decision makers comes from different people, from different places around the globe, at every meeting. The data is not routinely delivered by functional staffs. The decisions are sent to people around the world using constantly shifting information networks. The evidence is routinely displayed in live telecasts.[49]

A story in central Asia serves as an example. An executive decides to pursue a unique perspective. He relays his questions and directions to an anchor person or bureau chief. The anchor contacts a roving reporter (with satellite transmission equipment) who subsequently conducts a telephone interview to the remote location. The decision potentially traveled to the anchor by an internal digital network, the anchor relayed the desire through satellite transmission and ultimately a phone line served as the last link. At the conclusion of this fluid information network the remote reporter performs as directed and gains the knowledge the executive desired.

The personnel involved in this scenario are not members of functional staffs. They do not spend resources to specialize in specific areas. An industrial age organization might employ specialists to focus on a small part of the operation or environment. The specialists routinely report their knowledge through formal procedures. CNN, in contrast, began with a lean structure and managed to keep it "good, cheap, and flexible."[50]

Tom Peter's most recent works use the words "abandonment" or "revolution" to argue for change.[51] These words define his message, firms can not make incremental changes and compete with new firms. Emerging firms without centralized processes, bureaucracies, and specialists can outperform less agile large firms.

Today, business organizations are organizing in order to speed information. In the past, corporations organized in units (sometimes called divisions) to divide and complete large tasks. A new science perspective opposes reducing an organization's mission into small parts and organizing with a building blocks approach. This produces large

compartmentalized corporations. Margaret Wheatley suggests firms, like streams, adapt to their environment and mission. McKinsey and CNN, are examples of firms with fluid organizations. These firms take advantage of culture, traditions, and competencies to adapt and achieve profits. The reliance on core competencies echoes Wheatley's conclusions for organizations, when she studied self-organizing systems.

Learning

The creation of a learning organization is one strategy to deal with change. It is a process that facilitates the transformation of the organization in accordance with the environment. The environment section pointed out several impacts of the dynamics of change As a result corporations faced risk from assumptions that became false, outdated business formulas, and innovations both within and outside the firms traditional boundaries. Corporate leaders are challenged to constantly read and learn in order to stay on the leading edge of change. A learning organization shifts the burden of learning on many leaders throughout the organization at many levels. As a result, the organization can learn faster than the competition. Successful firms are then able to rapidly adapt and remain profitable.

"The ability to learn faster than your competitors. . . may be the only sustainable competitive advantage.", said Arie De Gues, head of planning for Royal Dutch/Shell.[52]

Paul Senge is the founder and Director of the Center for Organizational Learning at MIT's Sloan School of Management. He has put together a theory to assist corporations to learn from their mistakes,

identify patterns that effect the organization, and encourage continual individual and corporate learning.

His methods improve the chances of the organization remaining competitive in a constantly changing world. The increasing pace of change will create opportunities to fail, or learn, as each individual experiments with new ideas. In a learning organization it makes more sense to retain an individual who makes a mistake and learns than to fire him. He is in fact more valuable than a replacement who has not learned specific lessons critical to the organization's success.

Peter M. Senge describes five areas in The Fifth Discipline to cultivate learning in an organization. His approach ensures people anticipate and adopt techniques to address change. The premise is an organization that learns can adapt and effectively deal with change.

Senge takes time to describe a problem echoed by Margaret Wheatley, that is people, today, have a tendency to view problems with a Newtonian perspective. He states, "From a very early age, we are taught to break apart problems, to fragment the world. This apparently makes complex tasks and subjects more manageable, but we pay a hidden, enormous price."[53] He attempts to destroy the Newtonian perspective that the world is built upon small unrelated parts. In an earlier section of this paper, Wheatley argues a Newtonian perspective has been applied to almost every type of analysis over the last 300 years. Senge, like Wheatley, is interested in processes or the systems that create the end product.

Senge's learning organization has five disciplines: systems thinking, personal mastery, mental models, building shared vision, and

team learning. Systems thinking is the cornerstone of how learning organizations should think and view their world.

Systems Thinking

Systems thinking begins with the premise that complex tasks and subjects are built of related parts and forces. Taking a shower can illustrate a complex system.[54] It begins with required water pressure and your attempt to adjust the temperature. It's fairly easy and most of us do it every day without a second thought. You turn on the water, sense the temperature, and turn the knob until the water temperature feels right. It may take some minor adjustments but is generally quickly accomplished.

Consider, however, the difficulty when there is a 30 second delay between turning the knob and the new temperature. Now you must add judgement to determine when to make the next adjustment, how long to wait to measure the impact, or the variation of the next correction. Most of us would scald ourselves before determining a method to effectively control the temperature. Systems thinking is concerned with unseen forces and ponders distant results.

Two building blocks of systems thinking are reinforcing and balancing feedback. Reinforcing feedback is growth oriented. Balancing feedback is goal oriented.[55] The shower example is a balancing feedback system. The goal is to get the temperature just right. The arms race between the Soviet Union and the U.S. is an example of a reinforcing feedback system. In these systems, one may not anticipate how small actions can grow into large consequences. A run on a bank is another

example of a reinforcing system. Some small action "snowballed" into a series of reactions that cause a customer panic.

A battalion commander reacts in the defense by balancing forces against the enemy's initiatives. The commander reinforces success by committing a reserve force to exploit an opportunity in the offense. The commanders in these examples use balancing and reinforcing feedback to ensure success.

Regardless of feedback, the important concept is one's actions can impact in some unexpected area. It is essential to consider what part of the system you are effecting. Finally, a leader or manager, should impact those areas with the most leverage. In other words, attack the cause not the symptoms. During a bank run, locking the front doors attacks the symptom but will not solve the problem by the next morning.

Senge writes, "Today, systems thinking is needed more than ever because we are becoming overwhelmed by complexity. Perhaps for the first time in history, human kind has the capacity to create far more information than anyone can absorb, to foster far greater interdependency than anyone can manage, and to accelerate change far faster than anyone's ability to keep pace."[56]

Personal Mastery

Personal mastery is the discipline of seeing things objectively. It is not the practice of self-discipline or mastery of people. It is the discipline that challenges individuals to adopt a life-long learning approach. It is required in order to gain the

innovative insight necessary to compete in a constantly changing environment.

Senge states, "Organizations learn only through individuals who learn."[57] There are two important parts to personal mastery. The first is to continuously evaluate what is important to the individual and the firm. The second is to see current reality more clearly.[58] Senge suggests an environment that continuously questions truths, assumptions, and challenges the status quo will facilitate personal mastery.[59]

The U.S. Army accomplishes this through deliberate after action reviews. In a National Training Center rotation, individuals from brigade staffs to platoon are asked to comment on good and bad lessons learned. In this manner, the various teams learn from the individual members and see reality more clearly.

Mental Models

"Mental models" are the ingrained assumptions or generalizations that skew the individuals view of the world. It causes a subjective view. These models prevent corporations from putting new ideas into practice because they conflict with ingrained beliefs of how the world works.[60] Competitors can exploit this opening or the firm can lose potential profits. The networks belief of how news should be analyzed and packaged was a "mental model." CNN exploited this opportunity. American Broadcasting Company (ABC) now plans a 24 hour news broadcast in 1997. This is 16 years after CNN went on the air.

General Motors (GM) had a "mental model" of their business. It included the premises: GM is in the business of making money, not cars; cars are status symbols and styling is more important than quality;

workers do not have an important impact on productivity or product quality.[61] Obviously, the Japanese auto manufacturers forced them to reexamine their model after the loss of huge profits and market share.

The military, like any business organizations, has examples of ingrained assumptions and generalizations. Visionaries who championed such things as aircraft carriers, large armor formations, etc. . . attacked the "mental models" of those in the organization who believed in the status quo.

Shared Vision

A shared vision is the next discipline. According to Senge, "Shared visions emerge from personal visions."[62] In this composite vision each individual shares a responsibility for part of the whole vision. This process takes individual visions and builds a shared vision. This approach contrasts with the traditional "top-down" vision. The most important distinction is individuals are enrolled in the concept that they are part of the whole system. If they or some division of the organization are separated from the effort, the vision is unchanged. The workers who enroll in a shared vision are not "cogs in a machine." They are operators who adapt to adversity and succeed in reaching the objectives of the shared vision.

Team Learning

The last discipline is team learning. Senge writes, "teams must learn how to think insightfully about complex issues."[63] Team learning is a result of conversations between members. These conversations can typically be defined as dialogue or discussions. Dialogue is the art of suspending assumptions to explore complex issues

from many perspectives. It is a prerequisite of success for individuals to consider each other as colleagues. It is also useful to have a facilitator present who can keep the dialogue focused. Dialogue is based on inquiry and reflective skills. Discussion is the complement in which positions are presented and defended. A learning team is able to efficiently transition between dialogue and discussion.[64]

Reengineering

Michael Hammer and James Champy introduced the term reengineering in their book, Reengineering the Corporation[65], published in 1993. The topic of the book is about reunifying the many tasks found in the work place into unifying processes. It is another method organizations can follow in order to efficiently transform as required.

Hammer and Champy provide a formal definition of reengineering as, ."the fundamental rethinking and redesign of business processes to achieve dramatic improvements in critical contemporary measures of performance, such as cost, quality, service, and speed."[66] The attack on processes is a new science approach.

The key words in their definition are fundamental, dramatic, and processes. The reengineer attacks the fundamental assumptions and rules of the business. The goal of reengineering is to make quantum advances in performances not incremental improvements. Finally, the most important word is processes. The reengineer studies the problem, groups the tasks into a unifying process, and then improves the process. Processes are often invisible and unnamed.[67]

Hammer and Champy present a short history of industrial age bureaucracies. At the dawn of the industrial age Adam Smith published

The Wealth of Nations. He proved in the example of a pin factory that dividing work into several tasks could improve productivity by several orders of magnitude. Railroads extended the required span of control beyond the scope of any one man. Therefore, they developing formal operating procedures, more structure, and rules to meet every foreseeable contingency. Henry Ford further refined Adam Smiths work into tiny repeatable tasks. Alfred Sloan (CEO GM) then divided management into divisions to manage the huge organizations built along the structure of railroads and Ford. Finally, the process was completed immediately after World War II when executives like Robert McNamara at Ford and Reginald Jones at GE conducted elaborate business planning. In order to accomplish meaningful planning, corporate planners, auditors, and controllers were hired to ferret out data.[68]

The underlying assumptions of reengineering are based on three items already discussed in the environment section. Change is constant. Competition is intensifying. Customers are taking charge. No longer is the market place a seller's market. Customers feel free to change vendors based on price, quality, and timeliness.

Hammer and Champy suggest reengineering accomplishes the following goals. Firms become more efficient by changing the scope of jobs to address functions not tasks. This transforms the firm into a leaner less bureaucratic organization. Companies empower workers to make decisions and subsequently hold them accountable. Firms redesign processes into more flexible procedures that can handle a variety of inputs. As a result, firms can eliminate numerous processes able to do only one input. Firms reduce controls and checks. Finally, the flatter organization reduces handoffs between employees, staffs, and the

customer. This ensures fewer mistakes are made and the customer is quickly satisfied.[69]

The advantages of these principles seem intuitive. The firm can downsize and reduce payroll. As a result of this common practice, reengineering is perceived as a disguise for downsizing. Layers of bureaucracy are no longer required to make decisions for subordinates or manage the data of countless processes. The firm can maintain its level of quality by checking the product at the end-state and eliminating unnecessary checks. Finally, one case worker eliminates the chances of error in the handoffs between people or staffs. The total package speeds customer satisfaction, instills pride in the workers, and eliminates unproductive tasks.

Benetton is an Italian company that sells knitted goods. The company reengineered the traditional process of making sweaters. They attacked a process. Instead of dying the yarn and knitting the sweater, they knit the sweaters with a neutral yarn and dyed them to meet market demand.[70] Consequently, they delivered the clothing in the hottest new colors in step with fashion trends . The Italian company accomplished this goal and tripled sales in seven years to 1.7 billion dollars.[71]

Wal-Mart reengineered its inventory process. Traditionally twenty to thirty percent of the retail cost went into keeping inventory in three warehouses, the manufacturer's, the wholesaler's and the retailer's.[72] These warehouses were required to ensure supply kept up with customer demand.

Recently, I visited a Wal-Mart distribution center, the successor to two of the three warehouses. It is a transfer point for hundreds on trucks each day. Less than one percent of the products are

stored over 24 hours. Today, bar code scanners and computers guide the product from customer sale to restock with almost no human management. The product is electronically scanned (bar codes): as it departs from the manufacturer, as it arrives and departs the distribution center, and is it arrives and leaves the store with the customer. A typical elapsed time between the sale of a bag of potato chips and its restock is less than 24 hours. Wal-Mart used information technology and attacked the process (inventory). As a result, the firm gained a 20 to 30 percent savings, a significant advantage for Wal-Mart.

Reengineering seeks to combine tasks into processes. The use of information technology can often significantly improve the process once they are redesigned. A company named Titeflex that makes hoses, fluid and gas holding systems, demonstrates this event. In 1988, a typical order would go through a number of meetings. These "morning meetings", "purchase meetings", "design review meetings", etc. caused an order entry time of three to five weeks. The manufacturing process would take the hose through a myriad of departments consuming another six weeks. By automating the order, design, and production process the firm reduce the cycle (order to customer) to less than one day.[73]

The reengineering of processes that speed products to the customer are well rewarded. George Stalk and Thomas Hout of the Boston Consulting Group studied time-based competition. They discovered investments to reduce run-lengths times, improve quality, increase variety, and improve response time which reduced costs. They studied five companies, Wal-Mart, Atlas industrial doors, Ralph Wilson Plastics, Thomasville furniture, and the mortgage department of Citicorp. These companies responsiveness to customers was one-third faster than their

nearest competitor. Their rate of growth was three times greater than average in their respective industry. Finally, profitability was at least twice, and up to five times better than the competition.[74]

Leading

Leading is the final function, covered in this thesis. It assists organizations achieve an effective transformation. In military organizations, it multiplies the impact of maneuver, firepower, and protection in combat. In business organizations, it improves the previous functions, organizing, learning, and reengineering.

New leadership styles and principles are emerging as corporations change from machine to knowledge based production. Labor is shifting form blue collar, machine operators, to white collar, knowledge workers. The workplace is also changing to facilitate knowledge. Modern firms seek conditions to facilitate creativity and the exchange of knowledge. However, the requirement for current expertise and global competitive pressure, dramatically reduces the expectation of life time employment with one firm. If loyalty to the firm is based on a secure job, then information age firms must develop different means to influence or gain the loyalty of their temporary employees.

From Blue to White

Today, American society reflects the transformation of blue collar workers to knowledge workers. Knowledge workers are those individuals that process information. Dentists, actuaries, accountants are examples. Sixty percent of all American workers are knowledge

workers and eight out of ten jobs are in information intensive industries.[75]

Employment statistics indicate the U.S. rapidly transformed from an agricultural to an industrial economic base. Now, the transition is underway towards an information based economy. In 1913, fewer than one fifth of employees worked in industry.[76] In the 1950s, blue-collar workers comprised two fifths of the U.S. work force and in 1990 only one fifth.[77] In the mean time farmers today represent at most five percent of the population or one tenth of what they were eighty years ago.[78] The blue collar force is now migrating towards the knowledge jobs in the same manner agricultural workers left for industrial jobs. Today, Peter Drucker predicts the blue-collar force will represent less than ten percent of the work force in every developed free-market economy by 2010.[79]

Microsoft is a information age firm filled with knowledge workers. Fred Moody, a journalist, wrote, "Microsoft's only factory asset is the human imagination."[80] This firm seeks creative thinkers to imagine innovative software and concepts. Then it uses intelligent programmers to encode the concept into reality.

These information or knowledge workers carry the tools of their trade with them, in their head. If white collar employment predictions are correct, then information organizations like Microsoft may soon compete in the U.S. economy for a limited supply of creative and intelligent workers.

A recent lead article, "Siphoning U.S. Companies' Knowledge," in USA Today, discussed this very topic.[81] It describes how China's modernization drive is powered by one of the largest transfers of

technical knowledge and technology in history. The head of a European engineering giant, ABB, describes how employees simply vanish. When the manager goes to the employees apartment, it is totally empty. A few months later the former employee is seen working in the offices of a Chinese competitor. Then, "Donovan says, 'That's when I wonder, what did he walk away with? What's in his head?'."[82] The value of this employee is not in the physical labor he could provide. It's in his head.

The Workplace

In the information age, change and profits are facilitated by information. The emerging workplace is creating conditions to speed the transfer of knowledge and ideas. Some techniques include: creating a variety of teams, outsourcing for experts, and forming alliances.

One of the common approaches to management is to form teams. There is nothing new about teams coming together to solve problems. Teams are getting new attention now as the successor to high cost, low efficiency bureaucracy. These teams bring together experts as required. Functional staffs are eliminated. Occasionally a team may contract out for a specific expert. McKinsey & Company forms teams of internal and external experts to solve the problems of other organizations. General Motors may still have the ability to rely almost entirely on internal expertise. They may not want outsiders to gain knowledge of their internal constraints or problems.

Peter Drucker describes three types of teams as parables of business or project teams. There is the baseball team. It is comprised of players who each have an individual job. No one assists the batter when he gets to bat. There is the soccer team in which every player

moves with the ball but retain their position. Finally, there is the doubles tennis team. In this team each player must adapt himself or herself to the skills, personality, and abilities of the other.[83]

The organizing section documented many experts recommending a leaner, flatter organization. Their goal was to improve the speed of information and reduce costs. However, such actions frequently eliminate costly middle management and the knowledge those workers take with them. This knowledge is required to sustain existing business and perhaps for new missions. One solution is to contract for experts and pay them for the limited time they are required.

When an expert works on specific problems, he or she is fully engaged and commands a greater salary. One of Peter Drucker's former students is an expert metallurgist. In 1990, he was the executive of a fortune 500 company. Now he formed his own company and is still retained by five others. When a company calls he jumps into the problem with his full energy and is considered part of the team. Previously, he solved three or four metallurgical problems a year and the rest of his time writing memoranda.[84]

On March 13, 1995 Columbia/HCA Health contracted the purchasing and maintenance of all diagnostic instruments in three hundred hospitals to Medical Electronics Group of General Electric.[85] The Medical Electronics Group is the world's largest manufacturer of such instruments and therefore able to pick the most efficient tools for each hospital. The contract eliminated the cost of administrating thousands of smaller contracts. This contract enabled the firm to reduce staffs: dedicated to finding appropriate equipment, maintaining the equipment, and their supporting staffs for personnel actions or office supplies.

Another technique to gain knowledge and reduce structure is to form alliances. In the news you may hear of joint research, joint marketing, and other alliances under less formal names. In fact a number of alliances are not reported. Intel and Sharp have such a relationship. Intel, the American chip maker does research and development. Sharp, the Japanese manufacturer, then does the production.[86]

The emerging flat information age firms use teams, contractors, and alliances to eliminate staffs traditionally dedicated to senior executives. The employees are hired for required expertise. They are released as their skills perish or the job is complete. Employees serve customers and provide recommendations to senior executives. Therefore, the information age leader must: understand a variety of issues, earn the loyalty of temporary employees, and make decision on complex issues without the advice of a dedicated staff.

Earning Loyalty

In the past, blue-collar workers sought corporate employment because the factory provided them tools, a pension, and a job that required little skill and more sweat. Today the knowledge worker is the tool, can manage his own funds, and is not easily replaced like a cog in a machine. Therefore, corporations must earn the loyalty of employees who can volunteer to work elsewhere.

This is a paradigm shift from industrial age realities. Then, many employees gained a measure of security by returning consistently to the same job and workplace. Senge states, "We are trained to be loyal to our jobs–so much so that we confuse them with our own identities."[87]

Today, a job with American Telegraph & Telephone (AT&T) may no longer guarantee life time employment or an identity.

As corporations eliminate structure, employees can no longer discern an identifiable path to success. As firms contract out, reorganize teams based on mission, or sell unprofitable divisions the knowledge worker loses his sense of security. In this environment, one who is employed can not feel secure. Only one who is employable can enjoy peace of mind.

Rosabeth Moss Kanter, editor of the "Harvard Business Review", suggests modern firms provide their employees the opportunity to build their stock of "human capital."[88] This consists of opportunities to improve a resume through assignments or education. This is reminiscent of the learning organization proposed by Senge. A strategy, based on these principles (Kantor and Senge) would improve morale, productivity, and eliminate or reduce expensive external searches for recruits.

McKinsey & Company, a previous example, moved its employees from one team to another. The employees (experts) lead one team and provide support for the next. The workers are first loyal to their teams. As they join different teams they gain an essential network of past team members who are each unique experts in some area. Long term employees are loyal to their team, their network, and finally to "their" company.

CHAPTER 3

ANALYSIS

This thesis is based on the following argument. Leading corporations and armies are both complex organizations in the information age. Global competition will cause some management concepts to succeed while others fail in business organizations. The management concepts that succeed in business organizations are likely to succeed in future armies. The purpose of the analysis is to predict those concepts future armies are likely to employ in the information age.

Opponents may argue war and business are conducted in totally different environments. Therefore, business management concepts may not apply to combat organizations and global competition may not be enough to eliminate management concepts that can not meet the requirements of a wartime environment.

A couple assumptions are required to make the argument valid and relevant.

The first premise of this thesis states, war is a reflection of the societies who wage it. General Sullivan, Michael Howard, and the Tofflers provide examples to support this premise in the introduction. Although war and business are performed in different environments, the conduct of war often employs methods and techniques society uses to create wealth.

The second premise of the thesis states, the pace, complexity, and volume of change in society is very different from the past. It is the driving factor behind the management concepts in the literature review. This assumption limits the scope of management concepts to those that assist organizations to adapt to change. It also implies the conduct of war is changing for the most advanced armies.

A third assumption, not previously stated, is global competition can eliminate poor management concepts and highlight those that might transfer to military organizations. General Sullivan and Michael Howard both believe it is not critical for armies to field a perfect doctrine. What is important is the doctrine should not be too badly wrong. Furthermore, that armies need the capacity to quickly get it right once the moment arrives.[1] Management is a subset of doctrine, principles that guide the organization. Therefore, this analysis is not aimed at finding perfect management concepts for future armies. The goal is to discover corporate management concepts with military application that are not far from the mark.

The analysis follows the structure laid out in the literature review. Foremost in my mind is the repeated caution, mistakes in business cost money, mistakes in war cost lives. It is easier to lead employees who return home at night than soldiers into certain peril.

Environment

The environment of the near future is shaped by information. Tom Peters wrote that countries around the world are pursuing a value-added, knowledge-based, export-led economy.[2] The transfer of knowledge is increasing the pace, volume, and complexity of change. Business

organizations that can change with or lead the environment through change reap profits and decisive advantages over their competition. General Sullivan wrote the U.S. Army gains an advantage from change based on the nation's scientific and technological base.[3] Successful business organizations gain decisive advantages from the dynamics of change in the environment.

Pace of Change

Honda and CNN prospered from the speed of change. The two companies used the speed of change in two fundamentally different manners. Honda overwhelmed its competition by introducing more models in less time. As a result, the public gained more choice and rewarded Honda with market share. CNN developed a business formula based on the speed of information and information technology that can record change.

Honda's success formula, gain market share by speeding new models to market, was duplicated in the automobile, copier, and computer industries. Future armies can apply a similar strategy at both the operational and strategic level of war.

Information age armies may overwhelm enemy defenses by the rapid introduction of new models. For example, an army can build base models of unmanned aerial vehicles (UAVs). The base model may carry infra-red sensors to detect enemy systems. The enemy discovers this and develops an appropriate counter-measure. The sophisticated information army may then overwhelm his enemy by employing UAVs with stealth technology, thermal sights, millimeter wave sensors, and different ordnance packages to detect and destroy targets.

The pace of change is much slower at the strategic level but equally decisive. The following example describes how the U.S. military discovered a scientific breakthrough, derived an innovative military application, and sped the new system to the battlefield. Their enemy failed to discern the scientific potential, did not attempt to reengineer the technology, and suffered a decisive loss on the battlefield. The world watched. Emerging information age armies are not likely to make the same mistake.

The U.S. routinely bombed two strategic North Vietnamese bridges from 1965 until May, 1972. They also routinely suffered losses from surface to air missiles. Then in 1972, two sorties (one per bridge) destroyed the bridges beyond feasible repair with laser guided bombs. The impact and significance of the May 1972 attack was analyzed and published by Drew Middletown, a "New York Times" syndicated columnist in newspaper and a book.[4]

Nonetheless, military analysts, Saddam Hussein, and the majority of the world was surprised at the devastating and decisive impact of precision guided munitions in 1991. Despite unclassified analysis of U.S. precision air attacks, the enemy was unprepared for precision attack. The U.S. destroyed Iraq's forces from the air. Iraq failed to see the future and counted on an historically valid but obsolete paradigm to wage war.

CNN developed a successful business formula based on the speed of change and the capability of new information technology to record it. The U.S. Army is now "digitizing" its combat force to enable units to record and react to change. Third wave armies can use the speed of

information technology to assist the planning and execution of rapid attacks.

Wal-Mart, Thomasville furniture, Atlas industrial doors, and Ralph Wilson Plastics gained significant advantages by reducing run-length times, increasing variety, and improving response time.[5] This advantage translates into organizing and attacking faster than the enemy can react and counter-attack.

Third wave armies can employ sophisticated sensors and link them to shooters or planners. The shooter ultimately destroys the target almost the instant it is detected. The planner develops more sophisticated responses that require integration and prove equally decisive.

One of the tenets of war is to seize the initiative from your enemy. An army that responds to their enemy's action seems to provide initiative to the enemy. In this case, the opposite is true. Armies are seeking ways to reduce the sensor to shooter to impact cycle. Information age armies with digitally links can observe their enemy in assembly areas, traffic jams, fixed positions, and destroy him by fires. This army can observe their enemy, predict his actions, and destroy his options before he gains the initiative. The army that can more rapidly shoot and maneuver will end up inside his enemy's decision cycle and wreck havoc on his plan.

Armies can use the speed of change in two ways to gain advantages over their enemies. They can saturate the battlefield with numerous models with a variety of capabilities to overwhelm the enemy's

defense. They can also use the information of change to rapidly plan and execute attacks inside the enemy's decision making cycle.

Volume of Change

The quantity of change generally is a more negative factor for existing leading business organizations. In the corporate world the quantity of change is measured by the number of new products in the market place or patents awarded for new ideas. Dominant organizations such as railroad companies, IBM, and network news programs were succeeded by organizations with new technology or ideas. Dominant armies (Greek Phalanx, Roman Legions, Napoleon's Corps) were each followed by new organizations with new technology or ideas.

The dominant army that ignores the quantity of change within or outside its traditional domain, is as foolish an idea as the British Navy ignoring steam power in the 1800s.

Peter Drucker suggests organizations systematically examine their assumptions and core competencies against the changing environment for validity. The organizations are encouraged to constantly examine their formulas for success through models. Armies face a greater imperative to follow this strategy. Armies gain valid feedback in combat but may endure long periods of peace without appropriate information to guide a required transformation. The French and Polish Armies of 1939 arguably failed to transform as required.

Successful armies, like successful corporations must look outside their domain and national borders to discover new concepts. Corporations today fear and profit from new ideas and products that make current profit formulas obsolete. Military organizations have always

sought the next great weapon or its countermeasure. The business environment teaches us the number of discoveries are increasing every year.

Complexity of Change

The complexity of change has two impacts on business organizations. It favors organizations that can rapidly understand new complex ideas and bring a subsequent product to the market, first. It forces organizations with existing markets to improve the product or lose market share to new comers with improved products. Information age armies can field innovations first and gain advantages or they can fall behind modernizing armies that improve on existing systems and ideas.

Titeflex gained a benefit from the complexity of change. The firm used an internal digital network (complex concept) to reduce the customer order to product delivery cycle from 13 weeks to one day.

The complexity of change favors an army with the best creative thinkers. Peter Drucker suggested a twenty to thirty year time gap existed between concept and its innovative use. An information age army will enroll creative thinkers and contract others to reduce this gap.

The German Army in the late 1930's was first to synchronize the combat power of artillery, armored maneuver forces, and aircraft. Although other military theorists saw the potential, Germany was first to put the complex ideas into operation. The period (approximately 30 years) between the inventions (tank and airplane) and new battle doctrine parallels Drucker's estimate of the corporate innovation timeline. The army that reduces this period may enjoy the same advantages Germany did over Poland in 1939.

The complexity of change has another dimension as well. The organization that is first to market or can demonstrate a military capability is not ensured a lasting advantage. Intel corporation spends huge sums of dollars to stay ahead of its competitors. They ultimately catch up and are able to produce Intel's advanced products at lower cost. Intel is required to profit and recover its research costs before others can gain the market with less investment. Information age armies will balance the combat power and costs of research, production, and sustainment against their enemies potential to reproduce the system at lower costs or build its successor before the systems are required in battle.

The point is driven home when you consider Japan, in the 1980s, gained significant market share in a number of lucrative markets originally developed by U.S. firms. They improved existing modern products. Today the Israeli Air Force enjoys a reputation of superior fighter aircraft that they improve after American manufacture and delivery. All information age armies are likely to reverse engineer any technology breakthroughs as rapidly as possible.

Organizing

Information age corporations are racing to evolve beyond the hierarchical organizations sometimes called the military model. Corporations like McKinsey and CNN eliminate the need for traditional structures. They place decision makers closer to the action. They are rewarded with rapid decisions and execution. Information age armies, like corporations, can also reduce structure and layers of command in order to speed the decision making cycle.

When industrial armies adopt information age structure to speed information they can gain a variety of advantages. The corporate advantages, studied by George Stalk and Thomas Hout, included improved quality, increased variety, better response time, and reduced costs. The information age structures are lean or flat organizations. These firms also use teams, contractors, and alliances to gain information and meet mission requirements.

Third wave armies can eliminate unnecessary staffs with hierarchical (passes information vertically to senior leaders) and nonhierarchical (passes information horizontally or laterally to nearby leaders) digital networks. These systems should provide accurate, timely, and relevant information to decision makers throughout the battlefield. Senior leaders can gain information less skewed by intermediate staffs. These leaders can eliminate overwhelming amounts of data by adjusting filters and decision templates. Forward leaders may move rapidly (almost intuitively), based on pattern recognition, and relentlessly pursue the vulnerabilities of the enemy.

Chaos theory proposes decision makers step back to consider the whole. In the future, digital decision support systems aid leaders to discern critical patterns. The recognition of critical patterns can already be taught in the U.S. Army to a limited degree in networked weapon simulators and large unit computer war games. As a result, leaders can learn to make "intuitive" decisions and remain inside the enemy's decision cycle.

When both sides are using digital informational networks, the commander who first correctly discerns a pattern and executes

appropriate actions will arrive first at the decisive point. Margaret Wheatley's earlier discussion of chaos theory suggests analyzing the battlefield by the smallest units and quantifiable methods is futile. What is important is the recognition of a pattern and relationships. Effective commanders may attack the things (decisive points) that hold the pattern together or battlefield systems (relationships).

A reduced structure forces decision makers to make decisions forward. The senior decision makers in the rear are connected to a multitude of sensors. Their role is to overwatch large sectors of the battlefield. If they become embroiled in the control of one subordinate commander they will temporarily ignore their role of putting together the big picture based on their connectivity to different sensors. Senior commanders must narrow their focus to the big picture (an information age paradox) or face information overload.

Peter Senge and Margaret Wheatley both proposed corporate managers refocus their efforts to understand the system in which they operate. Battle commanders can not afford to believe their actions are separate or unrelated to other areas of the battlefield or national objectives. Senge described two types of systems, a balancing and a reinforcing system. In the defense, commanders and all who are connected by digital networks can react rapidly to balance their forces against the enemies initiatives. In the offense, all who are connected can respond swiftly to reinforce success and overwhelm the enemy at his weak points.

So far the discussion has focused on reducing levels of organization. Information age armies will also require efficient units

to reduce the strategic cost of sustaining them in peacetime and the operational costs of more requirements in war. Quantum physics and reengineers suggest a similar approach to transforming units.

Quantum physics suggests armies redesign processes not units or combat equipment to optimize combat power. Some processes are communications, indirect fires, and logistics. A focus on processes then guides the evolution of units. In corporations, assembly line workers who took one input and delivered one output now accept a variety of inputs and produce more than one output. A company of fuel tankers does one thing; receive, store, and issue fuel. In the future, can they receive, store, and issue any liquid? This might include water, liquid propellants, and exotic fuels for lasers or missiles.

The cavalry unit has properties like quantum particles. It can defend a position, move, and take on process like qualities by delivering fires and messages. Future armies will have more multi-role units and fewer specialists.

A new science approach to transforming an army would design its structure to facilitate productive relationships between the units. A modular force is an army proceeding down a quantum path.

The combination of effective commanders, rapid decision making, and flexible structure create self-organizing systems on the battlefield. These systems (organizations) rapidly shift structure based on anticipated change. The organizations of third wave armies adapt rapidly to balance the battlefield in the defense or reinforce success in the attack.

Margaret Wheatley tells the story of a stream high in the American Rockies. It swirls away from her. The water will continue relentlessly until it reaches the sea. The structure that carries the water may change from a stream, to a brook, to a creek, and finally a river before the water reaches the ocean. Wheatley states, "The forms change but the mission remains clear. Structures emerge, but only as temporary solutions that facilitate rather than interfere."[6] What remains important in this example is the process of the water traveling to the sea not the structure that carries it.

Margaret Wheatley's stream and John Holland's earlier (chapter two) description of a self-organizing system suggests the possibility of a truly fluid battlefield. Perhaps two thousand years ago, Sun Tzu wrote,

> Military formation is like water—the form of water is to avoid the high and go to the low, the form of military force is to avoid the full and attack the empty; the flow of water is determined by the earth, the victory of a military force is determined by the opponent. So a military force has no constant formation, the water has no constant shape: the ability to gain victory by changing and adapting according to the opponent is called genius.[7]

Today information technology and modern management can create a force that moves like water on the battlefield.

Present day corporations might foretell of third wave army structural changes. Today, firms like Asea Brown Boveri and McKinsey & Company have very little middle management. ABB has three layers of control between the CEO and 190,000 people. The "people" are divided into five thousand profit centers with approximately 40 employees each. McKinsey and Company is designed around thousands of ten man teams that

go from one project to the next. In addition, the members of the team constantly change and evolve based on the project and their expertise. Imagine an army corps with just three layers between the commander and thousands of formations of approximately 40 men.

The information age army of 2010 may attack with formations of 40 soldiers and their equipment that over time look like water in motion.

Learning

There are a number of principles embedded in the learning organization concept that can assist information age armies. Two principles stand out. First, the responsibility to learn is pushed down. The objective is to increase learning capacity of a few leaders to maximize the capability of many employees. Second, employees gain a universal appreciation for the role they play in the systems of their organization. The other principles include: personal mastery, mental models, shared vision, and team learning.

The changing environment of makes institutional learning a critical organizational skill in the information age. Michael Howard believes armies that get it right faster when war begins have the advantage. The quantity of change forces armies to incorporate and learn new ideas, discovered outside their traditional warfighting domain. Learning organization embed an organizational culture that supports this effort.

Systems Thinking

Systems thinking (a new science perspective) is the cornerstone of a learning organization. It requires workers or soldiers to consider

the impact of their individual actions against the system and toward other individuals. This challenges some individuals because systemic reactions are not immediately visible or even easy to perceive over time. Leaders must recognize the systems within the organization and devote resources to educate newcomers of the systems and their roles.

Corporate structures like CNN, McKinsey, and Asea Brown Boveri suggest information age armies place decision makers far forward on the battlefield. These decision makers are charged to make decisions without waiting for guidance. These decision makers should understand they are a small part of the system. In fact their section may equal 1/2000th (an ABB structure, 190,000 people divided into 2,000 divisions of 40 to 50 people) of the corps commander's combat power. When they defend a position, maneuver, request fires, etc. . . these leaders will balance their potential rewards against their demands on the system. A leader will have the situational awareness to determine the criticality of his position in relation to the entire battlefield.

The leaders of this organization are likely to learn through a combination of simulations and practice the impacts of their actions for the whole organization. Remember when both sides have information technology, victory goes to the swift. These subordinate commanders must learn to make critical decisions well. They will learn in peace the impact of wasting ammunition in one sector while another is over run due to lack of ammunition. They will learn how to reinforce success without detailed direction from higher headquarters. Combat leaders are likely to make the majority of decisions forward. Senior leaders will probably overrule by exception.

A Senge approach suggests future leaders must learn their impact on the system. In other words, if a future leaders commands 1/2000 of a corps, he must understand the corps commanders intent, corps vulnerabilities, and rapidly perceive the needs of his friends and weaknesses of the enemy.

Senge described two types of feedback to assist commanders in systems thinking. A person adjusting the shower's water temperature uses balancing feedback to achieve their goal. Leaders in the defense will continuously balance the battlefield against the enemy's action to deny any vulnerability. Leaders, far forward with information technology, respond so rapidly they balance the defense before an industrial age army can mount the offense.

A reinforcing feedback is the second type of systemic feedback. It occurs when small actions grow into large consequences like a bank run. Leaders on the offense continuously reinforce small actions to gain major victories.

The "learning army" decision maker's system thinking supports rapid decisions far forward and the effective use of resources. This army is likely to appear in continuous motion balancing the defense and relentlessly attacking vulnerabilities as they occur.

Personal Mastery

Senge states, "Organizations learn only through individuals who learn."[8] Successful armies in the future create a culture of learning. Any soldier can question the assumptions, conclusions, and status quo without fear of retaliation. Any organization failing to develop this

culture is destined to fall behind the pace of change. The discipline of seeing things objectively and life-long learning is called "personal mastery."

Mental Models

One of the areas Senge discusses is "mental models," preconceived assumptions of the environment. Individuals in a learning organization must remain aware of their own assumptions or realize generalizations can skew the information. Future army leaders should adopt personal strategies to remain objective. The networks lost market share to CNN when they failed to improve on their market. Although their networks delivery more than just news, they lost the opportunity to invest in a news network or new concept for news broadcasts. General Motors failed to forecast the publics demand for quality over cost. This concept is easy to explain but perhaps the hardest to implement. Leaders who abandon obsolete assumptions and implement new strategies avoid catastrophic defeat and earn decisive victories.

Perhaps, the Iraqi Army assumed the U.S. would fight through prepared defenses in 1991. Ultimately they counted on a body count discouraging the U.S. from continuing the fight. The French assumed the *Maginot* line would hold back the German Army in 1939. The impact of incorrect assumptions are easily seen.

Team Learning

The last discipline is "team learning." We know the organization learns when the individual learns. Yet, the individual is most likely to learn in and from the team to which he is assigned. The

learning process is facilitated by a dialogue based on inquiry and reflective skills. Discussion is the complement to dialogue. It occurs when positions are put forth and defended.

An information army leader can master the art of creating an open environment for dialogue. He can pull the members of the team together and ask insightful questions. The questions and answers in this environment cause the soldiers to discover ingrained assumptions and unravel complicated problems. The dialogue reinforces systems thinking for all involved. In this environment, soldiers understand the needs of others. The section or team he is part of becomes more powerful than the individuals.

This occurs today at all major exercises. After action reviews are conducted for all levels of participants. Each individual is focused on his impact to the team. At the national training center a brigade staff learns the impact of its actions on the brigade and on the other staff members. A tank crew is debriefed and learns their role in qualifying an individual tank as combat ready.

Reengineering

Reengineering is another management concept that can assist key leaders to transform an army in accordance with the environment. Once again the rapid pace of change drives the success and relevance of the reengineer. Information age armies can reengineer to improve responsiveness, speed information, and reduce costs by eliminating unnecessary staffs.

An information age army can reengineer to combine numerous tasks into one process. For example, a reengineer could link two tasks, locating (military intelligence task) and shooting (in this case, a field artillery task) into one process. The one process is placing indirect fires on distant targets. A reengineer would seek to combine or eliminate the hundreds of tasks required in this process without regard for branch identified functions. Then, he would apply information technology and new concepts to gain dramatic advantages. The end result is improved responsiveness.

Corporate examples can also suggest reengineering initiatives for information age armies. Wal-Mart's distribution system can eliminate unnecessary inventories and support personnel in industrial based armies. The Benetton method to change the color of sweaters closer to the customer instead of yarn at the beginning of production suggests battlefield refinements may provide the most rapid response to the enemy. The example of various models of unmanned aerial vehicles refined on the battlefield, discussed in the pace of change section, is derived from the Benetton example.

Corporations are eliminating unnecessary staffs by increasing the scope of jobs and flexibility of processes. Combat systems that can take on a variety of properties (roles) equate to increasing job scope and maximize the impact of improving the processes.

Reengineering echoes the new science theories of self-organizing systems and quantum physics. Organizations like self-organizing systems refine processes based on their prediction of the

future environment. Units and equipment, like particles in quantum physics, are designed to perform a variety of roles and missions.

Leading

Leading is the process that supports and facilitates the other functions, organizing, learning and reengineering. New leadership principles in emerging information age firms can transfer to armies. The labor required in both organizations is likely to shift from machine operators to knowledge workers (soldiers). Future army leaders are likely to design workspace on and apart from the battlefield to facilitate an exchange of knowledge. Information age armies may also employ a variety of teams, contractors, and alliances that like the corporate world reduce the soldier's loyalty to an immediate supervisor. Army leaders, like corporate leaders, can also provide their soldiers opportunities for self-improvement that reinforces loyalty.

Combat leaders have a reputation as unyielding, battle hardened, autocrats. The corporate world at one time enjoyed the same reputation. Ebenezer Scrooge is a well know character who represents this perspective. Regardless, of impressions, the corporate world seems to be transforming itself into a more caring environment. This is not occurring for altruistic reasons. It is happening because information age corporations succeed or fail due to the intellect and creativity of their employees.

From Blue to White

Modern corporations suggest people become the primary tool of information age armies. Their ability to digest, synthesize, and use

information that rapidly changes provides competitive or military advantages. It is essential for information based corporations to recruit, train, and retain intelligent and creative individuals.

Peter F. Drucker writes, "knowledge changes extremely fast."[9] Logically, the best tool to adapt to the changing knowledge is the human mind. Therefore, knowledge workers are the prized tools of knowledge based firms and potentially knowledge based armies.

The Workplace

The corporate workplace is changing to accommodate the employment of temporary teams, contractors, and alliances. The goal of corporate workplaces is to speed the exchange of information and ideas. Perhaps the U.S. Army is leading the way by fielding a digital network between combat systems. Support staffs can also increase their work space by conducting split based operations. These efforts use satellites to link home offices (with additional personnel, computers, and links to experts) to the battlefield.

Loyalty

If the information age armies adopt structures and philosophies similar to modern corporations, they are likely to face the same loyalty issue. Loyalty to the boss is lost as soldiers are assigned to different organizations. Armies may downsize and reduce the individuals sense of security. Armies may contract for temporary capabilities or develop alliances. At some point, the soldier wonders where to direct his loyalty. The corporate solution has so far been to create a culture that supports the objectives of the firm.

CHAPTER 4

THE U.S ARMY'S UNIQUE CHARACTERISTICS

How does this thesis relate to the U.S. Army? Some writers believe the U.S. Army is already the first information age army on the globe. The combat power derived from precision attack at Desert Storm is often cited as evidence. If you accept the premise that societies wage wars similarly to the way they create wealth, then the U.S. model has not completed the transformation.

The U.S. Army is the dominant land power today and clearly on the path to becoming the first information age army. However, the corporate world suggests U.S. dominance can rapidly erode due to a changing environment. The possibility of terrorists, organized crime, or nation-states using new or unconventional strategies and tactics continue to alter the environment in which the U.S. Army may be employed. Corporations are transforming due to multinational conglomerates, state subsidized firms, and smaller firms that change their business environment.

The U.S. Army is on the path of continuous transformation. General Federick Franks published TRADOC Pamphlet 525-5 on 1 August 1994.[1] This pamphlet lays down a conceptual base for the Army to consider as it evolves. TRADOC is charged to plan Army modernization. The publications of this headquarters are generally coordinated

worldwide to both higher and subordinate headquarters. Therefore, TRADOC publications deliver a consensus opinion of the U.S. Army's direction and serve as a reference to compare with other literature.

The U.S. Army gains the advantages of change due to its relationship with the largest industrial base in the world. It is important to maintain these relationships in order to discern change outside of the military domain. The U.S. economy has the potential to produce more new concepts regardless of complexity than any other nation on earth. Nonetheless, the number of patents awarded to foreign firms and individuals demonstrates the U.S will not control change.

General Sullivan, fearing complacency after Desert Storm, published an historical example of the requirement for a dominant power to seek change. He quotes JFC Fuller,

> Their lordships felt it their bounden duty to discourage, to the utmost of their ability, the employment of steam vessels, as they considered that the introduction of steam was calculated to strike a fatal blow at the naval supremacy of the Empire.[2]

The U.S. recognizes information technology can not be held back any more than the British could hold back steam power. TRADOC PAM 525-5 states, "Information technology is expected to make a thousandfold advance over the next 20 years."[3]

The information age army is dependent on digital networks to pass information. The U.S. Army's horizontal technology insertion (HTI), digitization, creates the first army with digital networks linking the majority of combat systems together.

The U.S. Army has been a dominant power in world affairs since World War I. The Army generally defeated its enemies with large divisions and corps. The organizing function section of the analysis

suggests smaller units may gain the advantage of agility. These units could react so rapidly to change that they flow like water against enemy vulnerabilities. A distant prediction of the future considers a corps of 190,000 soldiers based on the Asea Brown Boveri organizational model. This organization manages 190,000 people, in 2,000 units of 50 or less, with only three layers of organization. Senior leaders will face a significant challenge, if such a course is pursued. Nonetheless, there are a number of firms following this example in the face of global competition and the requirement to gain agility.

Peter Senge tells us those who have climbed the ladder to success are reluctant to yield its rewards, such as authority and responsibility. The process will endure attacks by senior officers. The downsizing also risks throwing the Army into chaos if leaders can not predict a successful career path. Nonetheless, it should be carried out as rapidly as the enemy, fiscal constraints, and acceptance of change allow.

The other difficulty for the U.S. Army may be the competition for intelligent, creative minds. The U.S. economy is increasing demand for these quality individuals. Today the Army still accepts a limited number of high school drop outs to meet accession requirements. Sophisticated equipment, more responsibility forward, and the requirement for continuous learning make quality soldiers an imperative. Today, leaders often state we have the highest quality soldiers ever. Tomorrow it is all relative to the other information age armies that emerge.

The U.S. Army comes out of the largest industrial society in the world. Since the turn of this century this nation has been successful in the vast majority of operations. The successful U.S. strategies overwhelmed her enemies with more men and better equipment (in a army-wide perspective). Although the U.S. has won wars of attrition, it seeks victories through finesse. In Desert storm the Army maneuvered with finesse while the Air Force reduced the enemy's combat power.

The U.S. Army is well positioned to develop the worlds first information age army. Although the U.S. Army accepts and seeks change, there is a deliberate effort at the senior levels to manage change. The army is like an oil tanker, it can not turn with the agility of a smaller motor boat. The introduction of an officer evaluation report serves as an example. The Army can design, publish, and distribute a new form to reorient leaders in a few months. However, the organizational culture and expectations that define good performance and criteria for evaluating reports will take years of feedback to establish. The senior leaders desire is to make productive leaps forward but not throw the organization into chaos.[4] As long as our potential enemies do not emerge with leap frog technology and information age concepts, the U.S. can afford this strategy.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

Those who will transform the U.S. Army in the information age can look at present leading edge corporations for inspiration. Man has waged war the way he creates wealth for thousands of years. Today, corporations offer a creative test bed for management concepts that may work for an information age army.

This thesis is about the future. Today, corporations face significant challenges to adapt as the leading economies transition from an industrial to an information base. New management concepts are emerging to guide these complex organizations through the transformation process to ensure they remain competitive in a new age. Today's leading armies must also transform to incorporate the advantages discovered by societies entering an information age.

The analysis of this thesis compares a number of management concepts published since 1990. The underlying principles of these concepts are grouped into four functions that assist organizations to change. They include: organizing, learning, reengineering, and leading. The conclusions of the analysis suggest concepts that any information age army is likely to employ. The effective concepts are proven in an environment of global economic competition not war. While all of the predictions may not turn out absolutely correct in a wartime

environment, they provide a forecast from which soldiers can adjust as war begins.

The driving factor behind new management concepts today are based on the dynamics of change. The environment is changing due to the speed, quantity, and complexity of new innovations. Future organizations, corporations or armies, as a result of change, can gain advantages or become obsolete more rapidly than in times past.

Environment

The pace, volume, and complexity of change alters the assumptions and facts upon which corporations base their success formulas. This implies corporations and future armies adopt a strategy of continuous transformation to avoid obsolescence.

Corporations gained some decisive advantages from the pace of change. Their successful concepts can transfer to future armies. They suggest armies gain the capability to modify or rapidly introduce a variety of models, with various capabilities onto the battlefield. This technique can overwhelm a less agile opponent's defense system. Additionally, firms with information technology more rapidly interpret the environment and improve responsiveness. The U.S. Army plans to improve its awareness of the environment and responsiveness with "digitization" technology. Future armies can gain decisive advantages over industrial age armies without these capabilities.

The volume of change is generally negative for the leading industrial age armies. The corporate world suggests leading firms are overtaken by organizations with new technology or ideas. Today's corporations suggest leading armies must discover relevant changes both

within and outside the traditional warfighting domain. Sometimes firms like the railroads and television networks, failed to understand the impact of change (trucks, airplanes, world-wide distribution of video cameras).

The complexity of change favors organizations with creative and intelligent people. There are two impacts from the complexity of change. Those first to the market or the battlefield with a good new idea are likely to win. Those who already dominate the market or battlefield are challenged by new organizations that can duplicate capabilities or improve on existing systems at less cost than the dominant organization. Successful information age armies must balances their resources to field good ideas first and continuously improve on their decisive advantages.

Organizing

Information age armies can follow the corporate lead and reduce layers of command and structure to speed the decision making cycle. Some present armies are designed around industrial age communication and information limitations. Today, corporations are eliminating unnecessary staff with information technology. The new structures speed information, empower line workers, and reduce costs. These firms desire leaders with a wide base of knowledge, the ability to learn, and the skill to create a learning environment. Successful future armies are also likely to reduce structure and employ similar leaders to gain an advantage over their opponents.

Margaret Wheatley's study, of self-organizing systems, leads her to believe firms organized around core competencies are better

prepared for an environment of change. A core competency of skills rather than business units can rapidly take advantage of opportunities. It is not locked into the boundaries of predetermined end products. These companies are more sensitive to the environment because they are seeking new markets for their expertise. Traditions, competencies, and culture can guide armies through a transformation to the information age.[1]

An information age army may maneuver like flowing water. Present corporations suggest these armies employ digital networks, well trained decision makers far forward, and senior commanders that limit their view to the big picture.

Learning

Learning organizations are one of the corporate responses to adapt to the environment. Senge writes,

> Perhaps for the first time in history, human kind has the capacity to create far more information than anyone can absorb, to foster far greater interdependency than anyone can manage, and to accelerate change far faster than anyone's ability to keep pace.[2]

Information age armies must speed their transformation to the information age and their delivery of new concepts to the battlefield. A learning organization accomplishes this is several ways. First, it transfers the responsibility of learning from few leaders to many soldiers. The assumption is the many can understand the impact of change better than the few. Second, soldiers are enrolled in the concept of systems thinking. As a result the will consider the impact of their reactions to change and not act precipitously. Finally, the

army encourages an environment to objectively analyze failure and encourage experimentation.

Reengineering

Some corporations are reengineering in order to transition into the information age. Reengineering follows a new science principle to study processes not units. Future armies that reengineer can eliminate unnecessary tasks, speed processes (such as indirect fires), and free up resources for other areas. Future armies can directly incorporate some ideas practiced by today's corporations. Wal-Mart and Titeflex demonstrate processes that reduce inventory costs and the production of custom parts. Present armies use both inventories and custom parts.

Leading

Leading facilitates the organizations attempts to improve structure, education, and processes. The U.S. Army already places a high value on leadership. In fact, some authors refer to the U.S. Army for examples of excellent leadership. The interesting difference of leadership in the information age is the quality of the workers. The transition from blue to white collar workers has caused firms to create a different work environment and develop new strategies to earn their loyalty.

The value of the best experts or keeping long-term employees current in specific fields of knowledge, changed the work environment. Rosabeth Moss Kantor suggests organizations provide employees the chance to learn current skills by rotating through a variety of jobs and with educational opportunities. This can often earn the loyalty of workers

who wish to remain employable. However, many firms take a low cost approach and simply hire experts as required.

The challenges documented by the various dynamics of change force information armies to access intelligent and creative soldiers. These soldiers might adapt sophisticated technology for a variety of specific missions far forward on the battlefield. Other soldiers must recognize the threat of new concepts both within and outside their warfighting domain. Creative soldiers are also required to continuously improve techniques and systems to stay ahead of foreign armies producing equal of better organizations at less costs. Since future armies require these intelligent soldiers, they must consider reward systems to earn their loyalty and retain their skills.

I have several recommendations for futurists or planners influencing the transformation of modern armies..

First, and most difficult, leaders should develop a strategy to ensure high quality, well educated (relative to the enemy and equipment requirements) soldiers find their way into the ranks. This strategy must focus on the long view out to 2010 and beyond. It should consider the quality at entry point, what can be taught, and how to retain the experience. It must take into account the increasing competition from a knowledge based economy. Potential strategies include: create a learning organization, adapt career paths to reward both military and civilian education, provide the best with a variety of jobs and problems, and perhaps least popular, reduce the size (and cost) of the force to improve the quality.

The army may have to outbid the successful firms for key talent in the near future. This competition can be counter-balanced with opportunities to trade with industry. Corporate training and civilian education can increase the probability of soldiers discovering change. The dynamics of change imply it will prove more difficult in 2010 to discover relevant change than today.

Second, leaders should embed the concepts described in Senge's learning organization into the military culture. Techniques such as dialogue, team learning, shared vision, mental models gain advantage from change. However, they often require an environment that permits experimentation. Senge points out that soldiers who try and fail provide a lesson for others. Furthermore, you can only learn if you have the power to experiment. An information age army can not afford to reward failure with dismissal. Those armies are likely to become stagnant, reward conformity, and like the railroads, fall behind new armies with different ideas and the courage to test them.

Third, leaders should reduce structure. Speed kills. Lean information age armies: speed information to decision makers, speed the transformation process, and speed a lethal response to enemy initiatives.

The final recommendation is to examine all battlefield tasks, processes, and structure with the theories of new science in mind. Improving processes yield dramatic benefits in the corporate world. If you attack processes, you may discover redundant tasks and gain decisive advantages. Changes to structure should include designing units like

quantum particles, that can perform a variety of roles and actions on the battlefield.

The corporate world can teach the Army survival techniques for the information age. Change will cause industrial armies to reorganize combat formations and the institution to speed battle responsiveness and speed innovations to the battlefield. The corporate world and quantum physics suggest the Darwinian motto, "survival of the fittest" is outdated. A new motto, "adapt or die" is perhaps more accurate in the information age.

ENDNOTES

CHAPTER ONE

[1]Martin Van Crevald, Supplying War (Cambridge: Cambridge University Press, 1977), 1.

[2]Michael Howard, War in European History (Oxford: Oxford University Press, 1976), 29.

[3]Ibid., 54.

David Eisenhower, Eisenhower at War 1943-1945 (New York: Vintage Books, 1986), 69.

[4]Michael Howard, "Military Science in an Age of Peace," RUSI, Journal of the United Services Institute for Defence Studies, March 1974, cited in The Evolution of Modern Warfare: Book of Readings (Fort Leavenworth, KS: Combat Studies Institute, 1995), 46.

[5]Ibid.

[6]Gordon R. Sullivan, America's Army: Into the Twenty-First Century (Cambridge, MA: Institute For Foreign Policy Analysis, 1993), 12.

[7]Alvin and Heidi Toffler, War and Anti-War: Survival at the Dawn of the 21st Century (Boston: Little, Brown and Company, 1993), p. 37

[8]Don Tapscott, The Digital Economy: Promise and Peril in the Age of Networked Intelligence (New York: McGraw Hill, 1996), 10.

[9]Charles Handy, The Leader of The Future ed. Frances Hesslebein, Marshall Goldsmith, and Richard Bechard, (San Francisco: Jossey-Bass Publishers, 1996), 3.

[10]Margaret J. Wheatley, Leadership and the New Science: Learning about Organization from an Orderly Universe (San Francisco: Berret-Koehler Publishers, 1993),

[11]William Bridges, The Leader of The Future ed. Frances Hesslebein, Marshall Goldsmith, and Richard Bechard, (San Francisco: Jossey-Bass Publishers, 1996), 17.

[13]Gordon R. Sullivan and Anthony M. Coroalles, Seeing the Elephant: Leading America's Army into the Twenty-First Century (Cambridge, MA: Institute For Foreign Policy Analysis, 1995), 30.

[14]Peter M. Senge, The Fifth Discipline: The Art and Practice of The Learning Organization (New York: Currency/Doubleday, 1990), 4.

[15]Peter Kline and Bernard Saunders, Ten Steps to A Learning Organization (Arlington, VA: Great Ocean Publishers, 1993), 13.

CHAPTER TWO

[1]Gordon R. Sullivan and Anthony M. Coroalles, Seeing the Elephant: Leading America's Army into the Twenty-First Century (Cambridge, MA: Institute For Foreign Policy Analysis, 1995), 12.

[2]Peter F. Drucker, Managing In A Great Time Of Change (New York: Truman Talley Books/Dutton, 1995), 76.

[3]Don Tapscott, The Digital Economy: Promise and Peril in the Age of Networked Intelligence (New York: McGraw Hill, 1996), 2.

[4]Tom Peters, The Tom Peters Seminar: Crazy Times Call for Crazy Organizations (New York: Vintage Books, 1994), 17.

[5]Ibid.

[6]Gordon R. Sullivan and Anthony M. Coroalles, Seeing the Elephant: Leading America's Army into the Twenty-First Century, 13.

[7]Ibid., 60.

[8]Joseph H. Boyett and Henry P. Conn, Workplace 2000: The Revolution reshaping American Business (New York: Penguin Books, 1992), 14.

[9]Ibid.

[10]Tom Peters, The Tom Peters Seminar: Crazy Times Call for Crazy Organizations, 7.

[11]Rosabeth Moss Kantor, When Giants Learn To Dance (New York: Simon and Schuster, 1989), 25.

[12]Ibid.

[13]Peter F. Drucker, Managing In A Great Time Of Change, 40-41.

[14]Ibid., 33. [15]Ibid., 34. [16]Ibid., 78. [17]Ibid., 40-41. [18]Ibid.

[19]Peter M. Senge, The Fifth Discipline: The Art & Practice of The Learning Organization (New York: Doubleday, 1990), 5-6.

[20]Kantor, 15.

[21]Joseph H. Boyett and Henry P. Conn, 14.

[22]M. Mitchell Waldrop, Complexity: The Emerging Science at the Edge of Order and Chaos (New York: Penguin Books, 1992) 14.

[23]Margaret J. Wheatley, Leadership and the New Science: Learning about Organization from an Orderly Universe (San Francisco, Berret-Koehler Publishers, 1993).

[24] Ibid., 129. [25]Ibid., 9. [26]Ibid27. [27]Ibid., 32.

[28]Ibid., 39. [29]Ibid., 76-77. [30]Ibid., 145. [31]Ibid., 145-147.

[32]Ibid., 87-94. [33]Ibid., 122. [34]Ibid., 122-131.

[35]Ibid., 129-133. [36]Ibid., 51.

[37]Tom Peters, The Tom Peters Seminar: Crazy Times Call for Crazy Organizations.

[38]William H. Davidow and Michael S. Malone, The Virtual Corporation: Structuring and Revitalizing the Corporation for the 21st Century (New York: Harper Business, 1993), 57.

[39]Peter Drucker, "The New Organization," Harvard Business Review, January-February, 1988.

[40]Charles Handy, The Leader of The Future, ed. Frances Hesslebein, Marshall Goldsmith, and Richard Bechard, (San Francisco: Jossey-Bass Publishers, 1996), 3.

[41]Peter F. Drucker, Managing for the Future: The 1990s and Beyond (New York: Truman Tally Books, 1992), 257.

[42]Tom Peters, The Tom Peters Seminar: Crazy Times Call for Crazy Organizations, 36.

[43]Ibid., 37.

[44]Wheatley, 16.

[45]Tom Peters, The Tom Peters Seminar: Crazy Times Call for Crazy Organizations, 37.

[46]Waldrop, 21.

[47]Tom Peters, Liberation Management: Necessary Disorganization for the Nanosecond Nineties, 133-143.

[48]IBID., 31-43.

[49]Tom Peters, Liberation Management: Necessary Disorganization for the Nanosecond Nineties, 34.

[50]Ibid., 33-42. [51]Ibid.,39.

[52]Tom Peters, The Tom Peters Seminar: Crazy Times Call for Crazy Organizations, 3.

Peter F. Drucker, Managing In A Great Time Of Change, 66.

[53]Senge, 4. [54]Ibid., 3. [55]Ibid., 89-92. [56]Ibid., 79.

[57]Ibid., 69. [58]Ibid., 139. [59]Ibid., 141. [60]Ibid., 172.

[61]Ibid., 173 [62]Ibid., 176. [63]Ibid., 211. [64]Ibid., 236.

[65]Ibid., 238-247.

[66]Michael Hammer and James Champy, Reengineering the Corporation: A Manifesto for Business Revolution (New York: HarperCollins, 1993)

[67]Ibid., 32. [68]Ibid., 32-35. [69]Ibid., 14-15 [70]Ibid., 50-64.

[71]Ibid., 57. [72]Ibid.

[73]Peter F. Drucker, Managing In A Great Time Of Change, 167.

[74]Tom Peters, Liberation Management: Necessary Disorganization for the Nanosecond Nineties, 63-70.

[74]William H. Davidow and Michael S. Malone, The Virtual Corporation: Structuring and Revitalizing the Corporation for the 21str Century (New York: Harper Business, 1993) 2.

[75]Tapscott, 7.

[77]Peter F. Drucker, Managing In A Great Time Of Change, 66.

[78]Ibid., 221. [79]Ibid., 215. [80]Ibid., 222.

[81]Fred Moody, The New York Times Magazine, (August 25, 1991); quoted in Tom Peters, Liberation Management: Necessary Disorganization for the Nanosecond Nineties (New York: Fawcett Columbine, 1992) 4.

[82]James Cox, "Siphoning U.S. Companies' Knowledge," USA Today, Feb 16 1996, B-1.

[83]Ibid.

[84]Peter F. Drucker, Managing In A Great Time Of Change, 89.

[85]Ibid., 66. [86]Ibid., 68. [87]Ibid., 69.

[88]Senge, 118.

[89]Kantor, 334.

CHAPTER THREE

[1]Gordon R. Sullivan and Anthony M. Coroalles, Seeing the Elephant: Leading America's Army into the Twenty-First Century (Cambridge, MA: Institute For Foreign Policy Analysis, 1995), 10.

[2]Tom Peters, The Tom Peters Seminar: Crazy Times Call for Crazy Organizations (New York: Vintage Books, 1994), 17.

[3]Gordon R. Sullivan and Anthony M. Coroalles, Seeing the Elephant: Leading America's Army into the Twenty-First Century (Cambridge, MA: Institute For Foreign Policy Analysis, 1995), 13.

[4]Drew Middleton, Crossroads of Modern Warfare (Garden City, New York: Doubleday & Company, Inc., 1983), 255.

[5]William H. Davidow and Michael S. Malone, The Virtual Corporation: Structuring and Revitalizing the Corporation for the 21str Century (New York: Harper Business, 1993), 23.

[6]Margaret J. Wheatley, Leadership and the New Science: Learning about Organization from an Orderly Universe (San Francisco, Berret-Koehler Publishers, 1993), 129.

[7]Sun Tzu, The Art of War (Boston: Shambala Publications, INC., 1988), 48-49.

[8]Peter M. Senge, The Fifth Discipline: The Art and Practice of The Learning Organization (New York, Currency/Doubleday, 1990), 139.

[9]Peter F. Drucker, Managing In A Great Time Of Change (New York: Truman Talley Books/Dutton, 1995), 339.

CHAPTER FOUR

[1]Headquarters Department of the Army, TRADOC PAM 525-5 Force XXI Operations (Fort Monroe, VA,: Army Training and Doctrine Command, 1994)

[2]JFC Fuller, The Conduct of War 1781-1961 (New Brunswick: Rutgers University Press, 1961) 91, as quoted in Gordon R. Sullivan and

Anthony M. Coroalles, Seeing the Elephant: Leading America's Army into the Twenty-First Century (Cambridge, MA: Institute For Foreign Policy Analysis, 1995) 17.

[3]Headquarters Department of the Army, TRADOC PAM 525-5 Force XXI Operations (Fort Monroe, VA,: Army Training and Doctrine Command, 1994) 1-3.

[4]Gordon R. Sullivan, America's Army: Into the Twenty-First Century (Cambridge, MA: Institute For Foreign Policy Analysis, 1993), 31.

CHAPTER FIVE

[1]Margaret J. Wheatley, Leadership and the New Science: Learning about Organization from an Orderly Universe (San Francisco, Berret-Koehler Publishers, 1993), 87-94.

[2]Peter M. Senge, The Fifth Discipline: The Art and Practice of The Learning Organization (New York, Currency/Doubleday, 1990), 69.

BIBLIOGRAPHY

Bridges, William. The Leader of The Future. ed. Frances Hesslebein, Marshall Goldsmith, and Richard Bechard. San Francisco: Jossey-Bass Publishers, 1996.

Boyett, Joseph H., and Henry P. Conn, Workplace 2000: The Revolution reshaping American Business. New York: Penguin Books, 1992.

Conner, Daryl R. Managing At The Speed Of Change. New York: Villard Books, 1995.

Cox, James. "Siphoning U.S. Companies' Knowledge." USA TODAY. 16 February 1996, B-1.

Davidow, William H. and Michael S. Malone. The Virtual Corporation: Structuring and Revitalizing the Corporation for the 21st Century. New York: Harper Business, 1993.

Drucker, Peter F. Managing In A Great Time Of Change. New York: Truman Talley Books/Dutton, 1995.

Eisenhower, David. Eisenhower at War 1943-1945 New York: Vintage Books, 1986.

Fuller, JFC. The Conduct of War 1781-1961. (New Brunswick: Rutgers University Press, 1961) 91. Quoted in Gordon R. Sullivan and Anthony M. Coroalles. Seeing the Elephant: Leading America's Army into the Twenty-First Century Cambridge, MA: Institute For Foreign Policy Analysis, 1995.

Handy, Charles. The Leader of The Future. ed. Frances Hesslebein, Marshall Goldsmith, and Richard Bechard. San Francisco: Jossey-Bass Publishers, 1996.

Headquarters Department of the Army. FM 100-5, Operations. Washington DC: HQDA. 1993.

Headquarters Department of the Army. TRADOC PAM 525-5, Force XXI Operations. Fort Monroe, VA: Army Training and Doctrine Command. 1994.

Howard, Michael. "Military Science in an Age of Peace," RUSI, Journal of the United Services Institute for Defence Studies. March 1974. cited in The Evolution of Modern Warfare: Book of Readings Fort Leavenworth, KS: Combat Studies Institute, 1995.

Howard, Michael. War in European History. Oxford: Oxford University Press, 1976.

Kantor, Rosabeth Moss. When Giants Learn To Dance. New York: Simon and Schuster, 1989.

Kline, Peter. and Bernard Saunders. Ten Steps to A Learning Organization. Arlington, Virginia: Great Ocean Publishers, 1993.

Middleton, Drew. Crossroads of Modern Warfare. Garden City, New York: Doubleday & Company, Inc. 1983.

Moody, Fred. "The New York Times Magazine." 25 August 1991. Quoted in Tom Peters. Liberation Management: Necessary Disorganization for the Nanosecond Nineties. New York: Fawcett Columbine. 1992.

Peters, Tom. Liberation Management: Necessary Disorganization for the Nanosecond Nineties. New York: Fawcett Columbine, 1992.

Peters, Tom. The Tom Peters Seminar: Crazy Times Call for Crazy Organizations. New York: Vintage Books, 1994.

Senge, Peter M. The Fifth Discipline: The Art & Practice of The Learning Organization. New York: Doubleday, 1990.

Shalikashvilli, John M., National Military Strategy of the United States: A Strategy of Flexible and Selective Engagement. Washington, D.C.: Joint Staff, 1995.

Sullivan, Gordon R. America's Army: Into the Twenty-First Century. Cambridge, MA: Institute For Foreign Policy Analysis. 1993.

Sullivan, Gordon R., and Anthony M. Coroalles. Seeing the Elephant: Leading America's Army into the Twenty-First Century. Institute For Foreign Policy Analysis: Cambridge, MA, 1995.

Tapscott, Don. The Digital Economy: Promise and Peril in the Age of Networked Intelligence. New York: McGraw Hill, 1996.

Toffler, Alvin and Heidi. War and Anti-War: Survival at the Dawn of the 21st Century. Boston: Little, Brown and Company. 1993.

Tzu, Sun. The Art of War. Boston: Shambala Publications. Inc. 1988.

Van Crevald, Martin. Supplying War. Cambridge: Cambridge University Press, 1977.

Waldrop, M. Mitchell Complexity: The emerging Science at the edge of Order and Chaos. New York: Simon and Schuster. 1992.

Wheatley, Margaret J. Leadership and the New Science: Learning about Organization from an Orderly Universe. San Francisco: Berret-Koehler Publishers. 1993.

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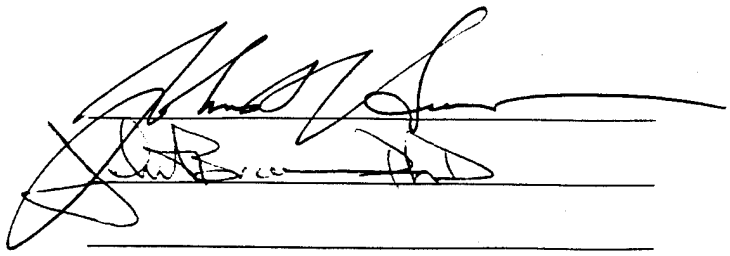

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